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[Special Editorial Correspondence.]

HURRIED NOTES FROM THE WASHINGTON CONVENTION.

WASHINGTON, D. C., October 17, 1894.

Dear JOURNAL: It is "almost" bedtime, and before saying good night I forward a hastily prepared synopsis of how the first day's doings of the 22d annual convention of the American Gas Light Association appealed to your correspondent. Ten years ago the Association met in this beautiful city, and was favored with fine weather and hearty welcomes; and as it was then so it is now. Charming weather and ubiquitous hosts are our portion, but through it all there rings the sad refrain that a hand which then was extended in the full strength of the magic of true fraternity and a voice that swelled with the harmony of eager welcome have been palsied and stilled by a conqueror who knows not defeat. However, memory was rife, and in convention and out of it one constantly heard, "Last time, McIlhenny was with us;" and no monument of stone or bronze can equal such record to the worth of our dead. Passing on to my task, it is my privilege to say that the attendance at the convention is a remarkably large and representative one, all sections of the country sending delegates. The special from New York carried 50, and the special from Boston, under the care of Mr. Prichard, brought on 31, and the West and South reported in sufficient numbers to bring the attendance up to 175, which is pretty good for a first day. The first day's proceedings moved along with ease, although the discussions were somewhat brisk, not to say animated, especially in the case of the paper (an added one) by Dr. Robert Amory, of Brookline, Mass., who discussed the subject of "State Gas Commissions" in a way that provoked considerable dissent from many of the debaters. This, however, is a trifle out of the straight story, which can be fairly reported on the following lines. President Pearson, who managed the assemblage with tact and discretion, was welcomed with resounding applause on calling the meeting to order, and Secretary Slater came in also for a cheering recognition. The report of the Council, among other things, declared favorably on the admission to membership of 1 Honorary, 19 Active and 11 Associate members (the Honorary addition being Mr. Allen R. Foote, of Washington, D. C.), which was an eminently satisfactory indication of the Association's vitality; and the Nominating Committee reported the following list of office bearers for 1895:

President—Walton Clark, Phila., Pa.

First Vice-President—C. J. R. Humphreys, Lawrence, Mass.

Second Vice-President—Irvin Butterworth, Columbus, Ohio.

Third Vice-President—Samuel G. Stiness, Pawtucket, R. I.

Members of Council—G. G. Ramsdell, Phila., Pa.; A. C. Humphreys, New York; Jerome Croul, Detroit, Mich.; A. E. Forstall, Newark, N. J.

This report occasioned much disappointment, in that from it the members learned that Mr. A. W. Littleton, of Quincy, Ills., who occupied the position of Second Vice-President last year, absolutely refused to accept an election to the Senior Vice-Presidency. He was prompted to this course by personal reasons that could not be disregarded; more's the pity. The resolutions adopted by the Association expressive of its regret at his resignation voice the honest sentiment of every member

who knew him. Looking along the perfected list (the gentlemen named were of course elected), the East has no particular reason for grumbling over the score of non-representation. Some minor matters followed, and then came the President's Address,[1] which was well received. Nothing out of the general run was contained therein, unless it be Mr. Pearson's semi-indorsement of the Welsbach burner for outdoor illumination, although it cannot be said that his expressions thereon are other than tentative. He also had an interesting chapter on water gas, that was historical and not altogether on the order *argumentum ad verecundiam*. On the whole, however, the member from across the border spoke his mind in untrammeled way, and I have no doubt the interest which it aroused in the convention will be awakened by it amongst the fraternity at large. The afternoon session was opened by the reading of Dr. Amory's paper, to which reference has already been made by me, and then came President-elect Clark's paper, which also provoked a rattling, good discussion. This closed the really technical business of the day. The afternoon and evening were devoted by the Committee on Entertainment to the substantial advantage of the ladies who honored the Association by their presence, the feature of the day entertainment being a drive to Arlington and other points of interests, while the evening's diversion consisted of a reception in the parlors of the Arlington, an informal dance bringing the affair to a sightly termination. It is on the cards that a group photograph, to be taken on the west steps of the Treasury Building, by Prince, who "took" the group in the same place 10 years ago, is the first thing for to-morrow.—C.

THURSDAY, October 18, 1894.

Dear JOURNAL: The weather continues fine and the attendance is nothing short of great, the new faces that prominently appeal being those of General Hickenlooper, Dr. Wilkinson, Messrs. Greenough, Warmington, Dunbar and Jenkins. The photograph was taken "all right," and it is a vast improvement on the one of '84, for instead of the dusky group of citizens who appear in that, this has for its relief the charming faces of the gentler sex who are assisting at the 22d annual. Business was continued with zeal. The paper by Mr. Egner was well received and thoroughly discussed. Besides the set numbers on the list, the Association considered the following additional papers: "Petroleum—Its Products and their Relation to the Gas Industry," by Mr. Charles H. Evans, of Chicago; and "The Backus Heater," by Mr. W. H. Frost, of Fort Scott, Kansas. The routine business was carried on cleverly and with dispatch, but the greatest trouble seemed to be not a lack of papers and queries, but the need of time in which to consider properly the budget at command. The banquet promises to be a great success, for almost all present have signified their intention to share its pleasures. I should have said at an earlier time that the '95 meeting is to be held in Philadelphia.—C.

THURSDAY, October 18, 5 P.M.

I presumed when my former budget of to-day's doings had been mailed that I had mentioned about all of impressive interest that would occur, but late in the afternoon a report was presented by the Council (as the result of a special meeting of that body convened for the purpose of considering Dr. Amory's paper and the discussion thereon), which favored the suppressing of the same, and the Association indorsed the findings. In passing it may be remarked that the Council could not have examined the Doctor's paper with care, for they originally indorsed it as qualified to be read. Another determination was reached by the Association which puts out of court the scheme for "Federation," a formal vote on the articles submitted for the proposed governing of "The Federation of Gas Associations of America" resulted in their decisive rejection.—C.

FRIDAY, October 19.

Dear JOURNAL: The banquet was in every sense a success, and proprietor Roessle, of "The Arlington," kept his promise to "do the thing up brown" to the letter. The number of members and guests who participated in the feast was not less than 150, and the toastmaster was no less a veteran than Samuel G. Stiness, who was as young last night as the youngest. It is well after "the walnuts and the wine," so let me sum it all up in the word that the whole proceedings were eminently harmonious and pleasurable. The weather this morning is just fitted for the business of the day, which is an outing the programme for which leaves nothing to be desired. A great many will stay over to-morrow to visit the Maryland Meter Company's new shops in Baltimore, a special train to make the trip having been chartered by the Company for 9:30.—C.

1. See JOURNAL, p. 578.

Address Delivered by President W. H. Pearson at the Twenty-Second Annual Meeting of the American Gas Light Association, Washington, D. C., Oct. 17th, 1894.

Gentlemen of the American Gas Light Association: A decade has passed since we last met in this beautiful Capital of the United States, and there are not a few present to-day who have most pleasant recollections of the hospitable manner in which we were then entertained. Commingled with these pleasant recollections is the feeling of sorrow that our honored and valued friend, George A. McIlhenny, whose name is still a household word amongst the gas men of America, and who did so much to render our former visit enjoyable, has passed forever from this scene of action.

Since we last met here, many matters of great importance affecting the interests of our industry have occurred. Electric lighting, then in its infancy, has made most marvelous strides, and so rapid has been its progress that at one time fears were rife that gas as an illuminant would, to a large extent, be superseded; but, happily, so far from such fears having been realized, gas lighting—from a combination of circumstances and largely on account of the demand for more light, caused by the introduction of arc lighting—has, during the last decade, increased at probably a greater ratio than during any decade since its introduction, while the consumption of gas for fuel purposes has gone up by leaps and bounds.

A glance at the progress of the gas industry since our last meeting will be in place. During a year of almost unprecedented financial depression such as the past has been, when almost every industry has suffered, when so great a diminution in the volume of business has taken place and disaster has overtaken so many, it would not have been cause for wonder had a reduction, both in the output of gas and in the profits of the companies generally, occurred; but, from the reports available, it appears evident that such has not been the case, and that, instead of retrogression having taken place, on the whole, substantial advance has been made. Through the courtesy of Mr. F. E. Barker, Chairman of the Board of Gas and Electric Light Commissioners of Massachusetts, who has furnished me with the figures for that State, and of Mr. E. C. Brown, who has kindly sent me proof sheets of his directory for the present year, I am able to state that, taking 90 companies, large, medium and small, fairly representing the different localities in the United States and Canada, there has been an increase in the output during the past as compared with the preceding year of 975,565,000 cubic feet, or 2.75 per cent., there being no reported increase in the population.

It is somewhat unfortunate that, owing to lack of information, a comparison of profits cannot be made with regard to the companies generally; but as far as the State of Massachusetts is concerned the information is available, and the results shown there may be considered fairly indicative of what has taken place throughout the whole country. It is pleasing to note that in Massachusetts the average dividends of 43 companies, supplying gas only, increased from 6.32 per cent. in 1893, to 7.53 per cent. in 1894, which is the highest average since 1886, when the statements were first published, and when the rate was 7.58 per cent. An inquiry naturally arises as to the reason for such results as those shown in Massachusetts, and the general increase in the output of gas throughout the country. I think the answer is not far to seek. Lower prices have in many instances prevailed, and gas of higher illuminating power has been supplied. In other words, a better and cheaper service has been afforded the public. Certainly, people are more economical in hard times than in prosperous ones, and the increased output looks like a recognition on the part of the public of the superiority and economy of gas both for lighting and heating purposes; and, at least as far as Massachusetts is concerned, the results referred to have been secured concurrently with an increase in profits. No doubt an important element in securing this result has been a decrease in the cost of production. Here I am led to refer to the large reductions in price that have taken place since the year 1882, when the first record of prices was published by Mr. Goodwin in his directory. In that year the average price of gas in the 90 places referred to was $2.41 per 1,000, while in 1894 it is $1.38, a reduction of $1.03, amounting in the aggregate on the output for 1894 to $37,510,530, or 42.7 per cent. The reduction from 1893 to 1894 amounted to 6½ per cent. I think we may safely say that the days of exorbitant charges for gas have happily passed, and that never again will it be possible for companies in large cities to charge from $2.50 to $3 per 1,000, as was the case not so very many years ago.

Comparisons frequently made between the present prices in America and England are always unfavorable to the former. While admitting that these comparisons are sometimes unfair, and that due consideration

is not given to the fact of the greater cost of works, the higher rate of interest payable when most of the works were erected, and the fact of the higher candle power of the gas supplied here, yet it cannot be denied that in some places there is still room for considerable reduction in price. It is to be regretted that these reductions are rendered difficult, in some instances, by a capital and bonded debt altogether out of proportion to the value of the works.

The question of public ownership of gas properties continues to be a live one, and as we have an excellent paper upon the subject (written by the First Vice-President, Mr. Walton Clark) for our consideration at this meeting, it would be out of place for me to go into it at any length, or to go over ground covered by him. There is one point, however, not referred to by Mr. Clark, to which I think it well to call your attention, and that is the claimed success of municipal ownership in Great Britain, Germany and other European countries, being made an argument for municipal ownership in America. And here it might be remarked that the impression has gone abroad that a very large number of British gas works are under municipal control. This opinion is erroneous, as I find, from the "Gas, Water and Electric Light Companies' Directory" for the present year, that out of 1,318 gas undertakings in Great Britain and Ireland, but 165, or about 12½ per cent., are under municipal control; 119 out of 947 being in England, and but 5, out of 80, in Ireland. While it must be admitted that in England the works operated by municipalities are generally as successfully and efficiently operated as those controlled by private companies, the differences in the condition of affairs existing in Great Britain and America have not had sufficient consideration. In Great Britain is to be found a large leisure class of retired merchants and men of business, who take a deep interest in advancing the welfare of their municipalities, and the civic spirit so prevails that there is an emulation between many of the larger cities in their efforts to be the best governed cities. The same can be said of Germany, where, generally, the aldermen are citizens of high character and ability, and the position being looked upon as one of great honor, is sought after by the best citizens; but here in America the position of an alderman is generally looked upon by this class as undesirable and derogatory to them, and there is a lamentable disposition, on their part, to evade civic responsibilities. It is, therefore, difficult to get really good and efficient men to enter our town or city councils, and it will not be disputed that many of the men elected to look after the large and important interests of our cities would not be placed in positions of trust and responsibility in the financial and mercantile world. That there are some good men is unquestionable; but in many cases the other element is too strong to allow them to accomplish the good work they would be only too willing to perform. Is it then to be wondered at, as Mr. Clark shows in his paper, that, as yet, municipal ownership in America has proved a failure?

The tendency to deprive companies conducting quasi-public works of their vested rights, and to practically confiscate their property, is becoming more marked as time progresses, and it will eventually shake all confidence in these undertakings if periodical raids are to be made upon their treasuries. That in some instances companies, by their exorbitant prices and indifference to the requirements of the public, have brought themselves into disfavor is not to be questioned; but in the vast majority of cases the companies have met the public demands in a fair and equitable spirit, and no reasonable ground for complaint exists. This clamor to deprive companies of their just rights often proceeds from municipal bodies, largely composed of men who, by the cry against "bloated monopolies," seek to curry favor with their constituents in the hope of obtaining for themselves that patronage and other advantages which the control of such undertakings would give them; and it is to be regretted that in some instances these men have been successful in accomplishing their ends. Newspapers, too, create ill-feeling by their bitter attacks, misrepresentations and untruths. These attacks are usually made by irresponsible men, whose object is not far to seek.

How to meet and overcome these attempts is a matter of deepest moment to all gas companies, and is worthy of our most serious thought. The first consideration is for each gas company to do away with all just ground for complaint, by charging reasonable prices, by supplying a uniformly good quality of light, by unvarying attention and consideration to the wants of the consumers, and by seeing that all are treated with courtesy by every employee. Greater satisfaction and public confidence could be secured by the appointment of government inspectors —to whom appeals could be made—for each place where gas is sold, and by the establisment by the State or Federal government of a standard of purity and illuminating power.

When conflicts arise between the public and the companies, there should be, if possible, an independent tribunal to whom all matters can be referred. To my mind, and as suggested in President Boardman's address last year, a commission should be appointed by the Governor in Council, similar to the one in existence in the Commonwealth of Massachusetts—which, after several years' trial, has, I understand, proved so successful, and has given such general satisfaction to both companies and the public. I think, however, it would be more desirable that the Commissioners, instead of being appointed for a term of years, should be appointed for life, only being liable to dismissal in case of inefficiency or misconduct, as is the case in Canada with regard to all government officials of lower grade than cabinet ministers. Such a tribunal would be the most independent that could be found. How to secure the appointment of such a commission is a subject for careful consideration, and will doubtless render necessary concerted action on the part of the various companies in each State. Perhaps the matter has not reached an acute enough stage to require immediate action, but doubtless further acts of injustice on the part of the authorities will bring it to a focus. I am sure that when the time comes valuable counsel can be obtained from the representatives of the gas companies of Massachusetts.

The strenuous opposition to water gas in the early years of its history on the part of the majority of coal gas engineers will be remembered by not a few now present, some of whom were then doubtless to be found in the ranks of its opponents. It is amusing, at this date, to look back at the various reasons that were given at the time to show that water gas had never succeeded, and never could succeed or compete with coal gas, and no allopathic physician could have ever looked with more contempt upon other systems of medicine than did the orthodox coal gas engineer regard this innovation at its early inception. As amongst the early advocates of water gas, and, as I believe, the pioneer in manufacturing and supplying it mixed with coal gas (which mixture I believe to give the most satisfactory light) and having incurred considerable odium and brought down upon my devoted head the strong censure of some prominent and esteemed members of this Association in the early days, I, of course, cannot but feel a good deal of satisfaction at the continued and rapid progress of water gas from year to year; and the gratification is enhanced by the fact that nearly all of my old opponents who are still in the gas-making business have fallen into line. A brief reference to its progress may not be out place. In the year 1878 there were, as far as I can ascertain, in the United States and Canada, but 12 companies manufacturing water gas, viz.: Utica and Yonkers, N.Y., Harrisburg, Lancaster, Manayunk, Phœnixville and Conshohocken, Pa., and Baltimore, Md., U. S.; and Brockville, Kingston and Toronto, in Canada. These, according to Goodwin's Directory, had increased to 66 in 1882, and according to Brown's Directory, in 1893, to 269 making water gas alone, and 87 making both coal and water gas. In all, 356 out of a total of 1,079 companies. As most of the larger companies are supplying either water gas alone or both kinds of gas, it is estimated that nearly two-thirds of the gas manufactured in America is water gas. Here I might remark that 42 of the companies whose names appear in Brown's Directory for last year have failed even to report so simple a matter as the kind of gas supplied. Why so easily-stated and uncompromising an item should be witheld is hard to say. Omissions to supply one or more of the items asked for are common. This is much to be regretted, as the information would make this useful directory much more valuable than it is. The meager reports given, in some instances, are in marked contrast to the reports in the English directories, which are most complete. Doubtless the reason for withholding these reports is the fear that the information might be used injuriously to the companies. I think that this fear is entirely groundless, and it is much to be desired that the companies withholding information will reverse their decisions hereafter.

Through the instrumentality of Messrs. Humphreys and Glasgow, whose energy and push are worthy of admiration, water gas seems to have at last obtained a foothold in Great Britain. Apart from the natural indisposition of Englishmen to adopt anything new, the objections made to the use of the gas on account of its carbon monoxide, high specific gravity, shortness of flame, stratification in the holders, etc., similar to those raised and successfully met in America twelve or fourteen years ago, there was what seemed to be a strong reason operating to prevent the introduction of the new system, viz., the long distance from the petroleum fields and the comparatively high price of oil. However, in 1891 the first works were erected at Beckton, and subsequently others were built at Glasgow, Belfast, Liverpool and Tottenham; also on the Continent at Copenhagen and Brussels. Mr. J. Stelfox, engineer of the Belfast Company, in a paper read before the Gas Institute, at Westminster, in June last, speaks enthusiastically of

the success of the plant erected for his company. He sums up as follows: "1st—That carbureted water gas, of 21-candle power, can be produced for less money than 17-candle coal and cannel gas, and this without taking into consideration the saving in interest on capital and the increased revenue from coke, not to speak of the many advantages and conveniences to which I have not ventured to attach a money value. 2d—That the enrichment of water gas, within the range of 17 to 26 candles, or even higher, can be effected at a cost of not more than 0.33d per candle."

After referring to the superiority of carbureted gas over other systems which are merely enrichers of gas, he concludes his able paper with these words:

"I believe carbureted water gas holds the field against all comers, and, given a supply of oil, at not exceeding present prices, it is bound to have a prosperous future." (The present prices referred to being 2½ pence per Imperial gallon, equal to 4 cents per w.m. gallon.)

With such testimony as that, and taking into consideration the fact that Great Britain enjoys the advantage of having two great competitive sources of oil supply—America and Russia—from which suitable oils can be obtained in unlimited quantities, with the prospect of the demand causing a reduction in price, it is quite safe to predict, notwithstanding the opposition still existing in high quarters, that before long water gas will be very generally adopted in the old country.

As President Boardman in his address last year referred so fully to the advantages of the Welsbach burner, and as a paper on "Some Experiences with the Lamp" is to be read at this meeting, I do not think it proper to say all that I otherwise might have said.

Since our last meeting the burner has been largely introduced in Great Britain and Germany, and is now beginning to make considerable headway in this country, some 30,000 having been placed in the city of Montreal alone. As we all know, the great drawback to the introduction of the light is the fragile nature of the mantle; but the Canadian agent has informed me that the inventor is at work in the preparation of a durable mantle, which he has good hopes of securing, and which he expects at the same time will give double the candle power of the present one. If the anticipations of securing this increased illuminating power are realized, it will be a marvellous light, as I have seen the original certificates of tests, made by the Government Gas Inspector at Montreal, showing 34.58 candles per foot of gas, and of tests made by the Inspector at Kingston, Ont., showing 31.37 candles per foot; but I am strongly of the opinion that there must be some mistake in these figures. I have had tests made in Toronto giving an average of 20 candles per foot. Of course these were new burners, and would, doubtless, somewhat deteriorate after being used for a time.

Some progress has also been made in the use of the Welsbach burner for street lighting. The *Gas World* of September 22 reports Mr. R. S. Galloway to have stated, before the Waverley Association of Gas Managers, at Portobello, Scotland, that the street lighting of Nicholson Square, Edinburgh, was with these lamps, burning 3¼ feet of gas per hour, the lighting being done by means of a by-pass, obviating the necessity of opening the lantern. In the *Journal of Gas Lighting* for June 19, 1894, there is an interesting and detailed account of experiments with these burners for street lighting, in Weisbaden, Germany, by Herr Muchall, manager of the gas company there. The burners were in use during the winters of 1892 and 1893, and the writer claims that, after paying for the chimneys, mantles, depreciation of burners, etc., the new system cost about the same as the old one, with an increased illuminating power of from 2½ to 3 times greater than was afforded with the ordinary burners. The experiment to light Rittenhouse Square, Philadelphia, with double Welsbach lights, referred to in a recent number of Light, Heat and Power, will be watched with great interest by all gas men, as most of us have been of the opinion that the field of street lighting would be almost entirely occupied by the arc light. I have had some of the burners, consuming 2¾ feet of gas per hour—instead of 5 feet consumed by ordinary burners—placed in street lamps in Toronto, for the purpose of testing them during the coming fall and winter, with a view, should the test prove satisfactory—*i. e.*, if the additional cost for mantles, breakages and lamplighting does not exceed the amount of gas saved—of offering them to the city, instead of lamps with ordinary burners, thereby giving them about three times the light for the same money.

The question as to whether gas companies shall recommend the general adoption of this burner at the risk of loss of consumption or continue to use the old ones, is a pertinent one; but, to my mind, the wiser policy is to adopt the burner which will give the largest amount of light for the least money; and, in the long run, this policy will best pay the companies.

According to Herr von Oechelhauser, General Director of the German Continental Gas Company, it appears that America is vastly behind Germany in the development and working of gas engines, as in the former country there is but one engine to 7,500 of population, while in Germany, in 1892, there was one for every 900 of the population—the statement regarding the number per capita in use in America probably being taken from Mr. Shelton's paper on "Gas Engines in the United States"[1]—and he gives as the cause of the smaller number in the United States that they cost more than steam engines, while in Germany they cost less. In giving this as the reason, however, he is in error, for undoubtedly the strongest competitor of the gas engine in America is the electric motor.

I have been fully alive to the importance of the use of gas engines, and (the cost of importing engines, owing to freight and duty, being then prohibitory), in the year 1880 my Company, by agreeing to take a certain number, induced a Toronto machinist to undertake the manufacture of the "Otto" engine, and these were sold at a much lower price than they could have been imported for. With considerable effort I was successful in getting about 70 introduced in two or three years, of sizes varying from 2 to 12-horse power; but since the introduction of electric motors the number has not increased. As elsewhere, the charges of the electric light companies in Toronto for power are elastic. Their ordinary, rate, however, is 4 cents per horse power per hour, while gas engines, with gas at our price—90 cents—cost only about 1.80 cents per horse power. The principal cause of the preference for electric motors is the small first outlay, being only one-third to one-half the cost of gas engines, as the following list of prices will show, and the fact that electric motors are leased at a moderate rental.

Net prices in Toronto of gas engines: 2-horse power, $350; 4-horse power, $450; 7-horse power, $600; 10-horse power, $775.

These were about the average prices in the United States some time since. I have, however, recently received a quotation from a firm giving considerably lower figures.

Net prices in Toronto of electric motors: ½-horse power, $65; 1-horse power, $85; 2-horse power, $110; 3-horse power, $150; 4-horse power, $175: 5-horse power, $200; 6-horse power, $250; 8-horse power, $300; 9-horse power, $350; 10-horse power, $400; 11-horse power, $450.

Unquestionably gas engines ought to cost considerably more than electric motors, but I do not think anyone will claim that there should be anything like the difference here shown, and it would be to the interest of both manufacturers and gas companies if the former would come down in their prices.

The adoption of gas engines for a greater variety of purposes than at present used for was discussed in the able paper of Mr. F. H. Shelton, at the last meeting of the Association, and, amongst other uses, attention was directed to a field almost entirely unoccupied, namely, as gas motors for street car propulsion, and a description was given of the Connelly Motor, said to be in about the shape they wanted it. I have written to both the Connelly Motor Company, Chicago, and the Connelly Engine Company, New York, for information on the subject, but could not obtain a reply, so conclude that nothing further has been done.

This subject was also referred to by my predecessor in his address.

In a monograph on "Progress in Gas Motors for Street Railways," published in Light, Heat and Power for August, Mr. Frank H. Mason gives a description of the Luhrig car, with certain modifications, worked on the lines of the Tramway Company, at Croydon, near London, England, which appears to be a success. The statement is made that a motor car of that type was then being constructed (July last) in England, to be carried to the United States, for trial during the present month, but so far I have not seen a reference to it in any of the JOURNALS. It would seem not improbable that a new and large field will be found for our product in this direction.

Owing to the rapid increase in the number of electric street railways, the subject of electrolytic corosion of gas and water pipes, by return currents, has naturally attracted a good deal of consideration on the part of gas men and others, and an able paper from Mr. I. H. Farnham has been published in the July *Quarterly*, and will be before you for discussion. Last year the Western Gas Association appointed a committee to consider and report upon the subject. The committee presented an able and voluminous report[2] at the May meeting of their Association, and very valuable suggestions were made as to the best methods of preventing the injury referred to. As an item of interest I would say that the Toronto Street Railway Company has shown every disposition to take measures to prevent injury to gas and water pipes and lead-covered telephone cables, from this source. The following precautions have

1. See JOURNAL, Vol. LIX., Nov. 13, 20 and 27, and Dec. 4, 1893.
2. See JOURNAL, May 28, 1894.

been adopted. At a point near its power house, a copper band 12 inches by one-eigth inch, is fastened around a 20 inch gas main, the pipe having been carefully scraped before the band was put on. After the band was placed, hot solder was poured on so as to leave no spaces between the pipe and the band. This band was well clamped together and bolted, and from it 5 half inch copper wires have been taken to the negative side of the dynamos in the power house. Connections have also been made from a water pipe in the locality in a similar manner. At seven different points within a radius of a mile, where the traffic is the greatest, half-inch No. 0000 copper wires are connected from the water mains to the rails and carried back, overhead, to the dynamos, and they are about increasing the number of these connections. Besides, numerous connections have been made between the rails and water-pipes. The rails are large, weighing 72 lbs. to the yard, and are firmly imbedded in concrete, thus making the joint more secure. The railway has been operated by electricity for over two years, and, although numerous excavations have been made, both by the Gas Company and the Water Works Department of the City, so far, no electrolytic action upon the pipes of either has been detected; nor, as far as has been ascertained, has any injury resulted to the telephone company, whose wires are underground, enclosed in lead pipes in conduits. The Railway Company has had in use, during the past year, 120 motor cars, and I am informed that the current averaged 2,000 amperes.

During the past year five worthy members of this Association have gone over to the silent majority. The first to pass away was Mr. Thomas C. Hopper, who died on 23d February. He was for many years Superintendent, and from 1877–1887 President of the American Meter Company, and a Trustee of that Company to the close of his life. He had large interests in a number of gas works. Mr. Hopper joined this Association in the year 1876. My acquaintance with him dates back to 1878, and in my business intercourse with him I had ever found him kind, courteous and obliging, a man thoroughly up in all branches of his work. In a sense, his death is to me a personal loss, and I shall, with many of you, miss his presence at our meetings.

Mr. Frederic A. Sabbaton, President of the Whitehall and Glens Falls Companies, and President and Engineer of the East Albany Gas Light Company, died at Troy, New York, on April 14th. He was one of the older members of the Association, having joined in 1873. He was an able engineer and thorough man of business, and was highly esteemed in the community for his integrity and geniality.

Mr. John H. Knowles departed this life at Richmond, Virginia, on the 5th of May, at the advanced age of 78. He became a member of the Association in 1879. He was Gas Inspector for the city for 11 years up to 1866. He was elected Superintendent of the City Gas Works in 1870, which position he retained until about 1886. His ability as a superintendent, business capacity and energy and faithfulness in the discharge of his duties are highly spoken of, and he was much esteemed for his excellent qualities as a man.

Mr. Paul S. Merrifield, Secretary-Treasurer of the American Meter Company, who joined the Association in 1879, died in Brooklyn on the 12th May last after a short illness. He was held in high estimation by his associates, and his loss will be mourned by all members of this Association who had the pleasure of his acquaintance.

Mr. Frank H. Dyer, Manager Salt Lake City (Utah) gas works, died March, 1893. The Secretary only heard of his death about a month since, and has received no further particulars. He joined the Association in 1891.

Suitable obituary notices will hereafter be prepared by the Secretary.

It is pleasing to note that, notwithstanding the numerous Associations in existence, the membership of the American Gas Light Association has steadily increased, from 340 in 1888, to 428 in 1893. However, it must be admitted that, with nearly 1,100 gas companies in the United States and Canada, a total membership, including associates, of 428, is by no means a fair representation. The large additions to the Association of members in early manhood, having the advantages of a technical education in the excellent schools now becoming so common throughout the country—advantages which many of the older members did not possess—augurs well for the future of the Association, and to these younger members must we chiefly look to explore the inviting fields of investigation, for which their educational advantages and enthusiasm specially qualify them, and which their comparative leisure affords them opportunity for doing.

The publication of the *Quarterly Magazine*, containing not only the papers of members, to be read at the Association meetings, but papers and other items of interest from outside sources, lists of patents relating to gas, lists of GAS LIGHT JOURNALS and classified indices of interesting articles in current literature, will doubtless be fully appreciated, and the publication in advance of the papers to be discussed at our meetings, affording ample time for their proper consideration, is obviously a very great advantage, and cannot but add greatly to the value of the discussions.

I should not be doing justice to our Secretary if I did not bear testimony to his marked ability, untiring energy and painstaking industry. The Association is certainly fortunate in having a Secretary who, in addition to his other acquirements, is so well qualified to edit our *Journal*.

Now, gentlemen, I fear that I must ask your pardon for having so long trespassed upon your patience. You have a number of admirable papers before you for consideration, and I trust the present meeting will rank amongst the best we have ever had.

The Inception and Development of Gas Lighting.

By MR. GEORGE LIVESEY.

The Goldsmiths Company's Technical and Recreative Institute, London England, have arranged for a course of 28 lectures on "Gas Manufacture," the first 10 of which are to be devoted to the chemistry of the subject, and are to be delivered by Mr. A. G. Bloxam, F.I.C. The concluding series (18 in number) will be prepared by Mr. W. J. Lineham, who is to deal with the practical sides of the subject; and the entire series is to be illustrated by illuminated diagrams and practical experiments. In casting about for a suitable person to inaugurate the series, the Company's choice wisely fell upon Mr. George Livesey, who, in the presence of a very interested audience, made the following address:

The Managers of the Goldsmiths' Institute having done me the honor of inviting me to give the address inaugurating a course of 28 lectures on "Gas Manufacture," I desire, in the first place, to thank them for this gratifying recognition of the importance and stability of the coal gas industry, and to express the hope that their effort will be appreciated as it deserves, and that the able and devoted lecturers will be rewarded by large and attentive audiences of students and others interested in the manufacture and supply of that useful servant of the public—coal gas. Moreover, this being the first time I have had the honor of sharing, in a small degree, in the work of the Goldsmiths' Institute, I take the opportunity of strongly commending it to the attention of all, especially the young, who are able to avail themselves of its great privileges and opportunities of instruction, recreation and social improvement. By so doing, the great munificence and public spirit manifested by the Goldsmiths' Company in founding and maintaining the Institute will meet with the acknowledgment most desired by the founders.

I am here, however, to endeavor to say something interesting on a rather large question—gas lighting, which has contributed in no small degree to the comfort and convenience, the safety and the progress of this and other nations during the present century. Artificial light is so necessary, and coal gas is so common, that few people now give it a thought, except on those rare occasions when, like all other human inventions, its want of perfection is proved by some defect in its supply or use. Attention was probably first drawn to it in the form of natural gas issuing from the earth, which ignited on the application of a light; and one observer—the Rev. Dr. John Clayton, Dean of Kildare—rather over 200 years ago, not being satisfied with merely applying the light at the surface, had a hole dug, and found what he describes as a "shelly coal," from which the gas appeared to issue. This led him to distil some coal in a retort, thus producing coal gas. This he collected in bladders and amused himself and his friends by pricking a hole with a pin, and, to use his own words, "compressing gently the bladder near the flame of a candle till it once took fire. It would then continue flaming till all the spirit was compressed out of the bladder, which was the more surprising because no one could discern any difference in the appearance between these bladders and those which are filled with common air." And for a very good reason, because it was nearly 100 years later—towards the end of the last century—that the great chemists of that period first discovered and isolated the various gases composing air, water, etc., which are now known, by name at least, to every schoolboy.

Nothing practical, however, came of the possibility of producing gas by the distillation of coal. It was then called inflammable air, until William Murdock, a native of Scotland, in 1792, when residing in Cornwall, directed his attention to the quantities and qualities of the gas obtained by distilling various mineral and vegetable substances, and being struck with the great quantities of gas, the brilliancy of its light, and the facility of its production from coal, he made experiments, with the view of ascertaining its suitability for the purpose of artificial lighting. On his return to Scotland in 1797 he lighted his premises at Old Cum-

nock in Ayrshire with coal gas. In 1798 he was engaged by Messrs. Boulton & Watt, at the Soho Foundry, Birmingham, in the manufacture of steam engines. There he erected an apparatus on a large scale, by which one of the principal buildings was lighted; and, in 1802, in celebrating the Peace of Amiens, the whole front of Boulton & Watt's buildings was publicly illuminated with gas. In 1804 F. A. Winsor, a German, lectured on gas light in London, with the object of forming a National Light and Heat Company, which he, in his enthusiasm, estimated would yield a profit exceeding 100 millions a year, with the result that in 1806 he was supported by a large and influential body of subscribers, who, encouraged by the first public street lighting with gas, which took place in Pall Mall on Jan. 28, 1807, formed a Committee, which met on July 12, and may be considered the first official assemblage in connection with the Chartered Gas Company, who, in 1810, obtained their first Act of Parliament, and in 1812 received a Royal Charter of Incorporation, whence they derived the name of the "Chartered" Company. In 1813 they had the good fortune to engage Mr. Samuel Clegg, formerly a pupil at the Soho Works (who had been occupied since 1805 in the invention of apparatus and the design and erection of gas works for mills, manufactories and private houses), as their Engineer. Under his direction, their works were constructed; and on December 31, 1813, old Westminster Bridge was lighted with gas.

Other companies soon came into existence. In 1814 both the City and the South London (afterwards called the Phœnix) Gas Companies were formed, and others rapidly succeeded them in the course of the decade, not only in London, but in many important provincial towns. No sooner, however, was a company fairly started than a competitor or competitors usually followed, with the result that much money and energy that might have been profitably devoted to the improvement and general extension of this important business, was wasted in fighting each other, to their own loss of profit, and the injury of the public. The consumers themselves were largely responsible for this competition, as they were very frequently the promoters of competing companies, which were generally started for the avowed purpose of reducing the price of gas; and although this object was usually attained at first—accompanied generally by a reduction of the already very meager dividends to the vanishing point—the after effect was that the consumers had to pay interest on a very much larger capital than would have been necessary had competition been avoided. In very early days, Sir William Congreve—the Government Inspector of Gas Works—on the ground of safety, strongly urged the Chartered and City Gas Companies to adopt districting arrangements in the city of London. But the City Company were strongly opposed; and only on Government threatening to bring in a bill to enforce districting was a voluntary arrangement made, whereby each Company had allotted to it a separate district. In the city of London this arrangement remained in force until 1850, when the Great Central was started to supply the whole of the city, in opposition to the existing Companies; but throughout nearly all the rest of London competition prevailed. The Directors and Officers of the various Companies derived much greater satisfaction in taking consumers from rival Companies than in obtaining new ones. Such is human nature; truly man is a fighting animal. And so the game went on for forty years—gas dear and dividends low—until competition became intolerable. It was not at all unusual for three, four, and occasionally even five different Companies to have mains in the same street, and often on both sides. This was the case to my knowledge in 1853, in the Walworth Road, where the Phœnix, South Metropolitan, London, and Surrey Consumers' Companies each had mains on both sides. Therefore there were eight mains, where two would have been sufficient, and where at the present time there are only two. The streets were continually being opened, for the consumers were constantly "ringing the changes" between the Companies, either on their own motion or at the solicitation of the rival inspectors; and great public inconvenience and loss, as well as confusion and quarrelling between the Companies, were the result.

The death blow to competition was given soon after 1850, in which year the Great Central Company was started to supply gas in the city, and the Surrey Consumers' Company in South London. The price of gas was then $1.50 per 1,000 cubic feet. Mr. A. A. Croll, the founder of both these Companies, undertook to supply gas at $1 per 1,000 feet; and as the old Companies obstinately and foolishly would do nothing in response to the public agitation that was at that time set on foot to obtain a reduction of price (a reduction to $1.25 would have sufficed, if in time, but it came too late), those Companies came into existence, and all the Companies were then forced in self-defence to reduce to $1. This had a double effect. It caused a heavy loss to the Gas Companies, necessitating a considerable reduction of the dividends. They had been paying about 5 per cent., and that of the South Metropolitan was 6 per cent., and all had to come down. But there was another and unexpected effect. The new Companies had, before starting, obtained promises from many thousands of consumers to take the gas—as was natural with such a bait as a reduction of 50 cents off $1.50—from them. But when the old Companies came down to $1, large numbers of the consumers would not change. Consequently, the working of the new Companies was not so rosy as had been expected, and, so far as I know, these were the last competing Gas Companies that were actually started in the kingdom. Competition had been thoroughly tried; and it had failed, for in 1853 the four Southern Companies (including the new one), entered into a districting arrangement whereby South London was so divided that a separate and distinct district was allotted to each Company. The price was raised from $1 to $1.12 per 1,000 cubic feet; and an unbroken period of prosperity for the Gas Companies, and a cheap and efficient supply of gas to the consumers, was entered upon. In 1857–58. the example of the south was followed in the north of London, and in 1860, the private districting arrangements of the Companies were approved and confirmed by Parliament. From that time competition gradually ceased all over the kingdom. Where it existed, arrangements have been made, and Parliament has consistently refused to sanction new competing gas companies. The number of gas companies in London proper about the year 1850 was 15. They have now, by amalgamation, been reduced to 3, and there are in addition 12 other smaller Companies supplying gas in the suburbs—including such places as Croydon.

In the early days the dividends were either wanting altogether, or they were very small. The average dividend paid by the Chartered Gas Company during 28 years, up to 1840, was less than 2½ per cent.; and until districting had time to produce its effect, nearly 20 years later, anything above 5 per cent. was very uncommon. But since 1860 the maximum dividend allowed by Parliament has generally been paid; while the price of gas has been reduced to about one-half of what it was in 1860. In this part of London it was then $1.12 per 1,000 feet; it is now 58 cents.

Although the gas meter was invented by Clegg in 1815, it was many years before it came into common use. Gas was generally supplied by contract, at so much per burner burning for so many hours each night; and inspectors were appointed to visit the shops of the consumers, to inspect their burners and to see that they used them only during the stipulated hours. This was an extremely unsatisfactory arrangement. The Companies had to charge an average price per burner sufficiently high to pay them, with the result that the honest and conscientious consumers paid much more than they ought to have done, to make up for the waste and dishonest use of gas by the unprincipled, who objected most strongly (and for a long time successfully) to the use of meters, until in self defence the Companies at last resolved, by mutual agreement, to supply only by meter.

When meters were first introduced, the price of gas in London was $3.75 per 1,000 feet, reduced in 1832 to $3, and then, by steps, to $2, in 1843. It was $1.50 in 1848; $1.25 in 1850; $1, under pressure of competition, in 1851; $1.12 in 1853; $1 again in 1862; and then, by steps of a few pence, and latterly by single pennies, to its present price of 58 cents in this district. These reductions are the result of a variety of causes. Improvements have been effected in manufacture, whereby, with other advantages, more gas is made out of the coal. Then there is the lower cost of materials—coal among the number; but this is due to the substitution of steamers for sailing ships, whereby freight from Newcastle has been reduced to about 81 cents per ton, which alone accounts for 8 cents of the reduction that has taken place in the last 25 or 30 years. This is an "unearned increment" for the consumers supplied by the three London Companies, of about half a million a year. Labor, on the other hand, has gone up from 50 to 100 per cent.; the wages of skilled workmen having advanced in the last 50 years about 60 per cent., while the wages of laborers, which in 1838 were 62 cents a day of 10 hours (or 6 cents an hour), are now 100 per cent. higher, or 12 cents an hour. One result, however, of the increase of wages—especially during the last five years—has been the extensive substitution of machinery for hand labor; thus materially reducing the number of men in proportion to the work done. The introduction of machinery is an element in the reductions of price; but probably the chief factor has been the enormous increase of business. I am able to give some figures for the Old Kent Road works, which will forcibly illustrate this point. The works were started in 1833; but in 1843—50 years ago—7,744 tons of coal were used, producing 72,567,000 cubic feet of gas, or 9,371 feet per ton. In 1893, 176,255 tons were used, producing 1,784,426,000 feet

of gas, or 10,123 feet per ton. The coal used has, therefore, multiplied about 23 times, and the gas made, 24½ times, in 50 years. To put it in another way, about the same quantity of gas was made in one week last winter as was made in the entire year 1843. Again, in 1843, there were at those works five gasholders, whose total contents were 213,000 cubic feet. There are now eight, whose total contents are over 11,000,000 cubic feet, or about 50 times as much. The largest gasholder in 1843 at the Old Kent Road works contained 69,000 cubic feet; the largest now there has a capacity of 5½ millions, or about 80 times larger, while this is less than half the capacity of the Company's largest holder at East Greenwich, which will hold above 12,000,000.

The increase in the capacity of gasholders has greatly reduced their relative cost. The 69,000 cubic feet holder was erected in 1840, and cost over $200 for each 1,000 cubic feet capacity, and many years later $100 was a very moderate price. But the 12,000,000 feet holder at East Greenwich cost only $25 per 1,000 feet; the total being a little more than $300,000. Had it been at the rate of even $100 per 1,000 feet, it would have cost about $1,250,000. The interest on the amount saved is about $50,000 a year, which means a reduction in the price of gas to that extent to the benefit of the consumers.

The capital employed by the South Metropolitan Company was in 1843 $500,000, or at the rate of $8 per 1,000 cubic feet of gas sold; in 1893 it was 3¼ millions, or only $2.64 per 1,000 feet. This great relative reduction of capital in proportion to the business is vastly to the benefit of the consumers. It is due to improvements in construction and working, coupled with, and to a considerable extent caused by, the increase of business. If the capital now were as high per 1,000 cubic feet as it was in 1843, and the present average nominal dividend of 9¼ per cent. were paid, the price of gas would have to be increased from 58 cents to $1.04 per 1,000 cubic feet.

In most ordinary businesses it is the main object of the proprietors or conductors to obtain the highest possible price for their goods. With gas the reverse is the case. It is now generally recognized and adopted in practice that it is to the advantage of gas companies to sell gas at the lowest practicable rate. By the original system of legislation as applied to gas companies, they had no inducement to reduce the price. They had a monopoly of a certain district, and they were permitted to charge such a price as would give them their full authorized dividends. This was fatal to enterprise and effort; and as they were allowed, as their businesses increased, to make new issues of shares at par to existing shareholders, they certainly had no inducement to economize capital, but rather the other way. Under these circumstances it is much to the credit of the managers of those days that, as a rule, the capital relatively to the business was gradually reducing, though not so fast as otherwise it might have done.

In 1875, however, a new system was introduced in the shape of a sliding scale of price and dividend, whereby the companies were authorized to increase their dividends ¼ per cent. beyond the standard rate for each penny reduction in the price of gas below a fixed initial figure. The initial price is 93 cents for the north of London, and 87 cents for the south. On the other hand, if the price is raised above the initial rate, the dividend must be reduced ¼ per cent. It is consequently to the direct pecuniary interest of the shareholders to sell gas at the lowest price possible; and the result has been satisfactory both to shareholders and consumers—the former getting increased dividends following, and in consequence of, reductions of price to the latter.

In 1876, as a complement to the sliding scale, Mr. (now Lord) Farrer, then Secretary to the Board of Trade, induced Parliament to adopt as a Standing Order what are known as the auction clauses in relation to gas companies. He, in effect, said that for the future no more capital bearing a high dividend should be issued at par, but at the market price. It was to be sold by public auction or tender; the premium received, if any—and it has usually been considerable—to go as capital into the business, without bearing interest. The result has been that since 1876 all new capital created by gas companies has been raised at about 5 per cent., instead of the nominal rates of 7, 7½, or in some cases 10 per cent.; thus materially reducing the charge for interest on capital, which the consumers have to pay in the price charged for their gas.

The sliding scale has given a strong impulse to adopt measures to increase the business, which, although not at the old rate of doubling every 10 years, is going on satisfactorily at a rate still very considerably in excess of that of the increase in the population. The consumption of gas in South London has doubled in the last 15 years. Prior to 1870 the only competitors gas had to meet were candles, and oil at about $1 or $1.25 per gallon—sperm oil was even more than that—resulting in a practical monopoly for gas. With the advent of petroleum, and later the electric light in an available form, the case is entirely altered. Gas has fierce competition, and no monopoly as a lighting agent. Burning-oil can be bought for pennies where it formerly cost shillings; and with exceedingly cheap lamps, an excellent light is obtained at a very low rate. On the other hand, there is the brilliant, but expensive, electric light, whose advocates and promoters have done all in their power, since 1878, to supersede gas. It is a singular coincidence that this period is the same as that referred to above in which the consumption of gas in South London has doubled. This shows that, against cheap petroleum and the electric light, gas not only holds its own, but continues to gain ground at a most encouraging rate. Let it be remembered that the greater part of the above named increase is in the demand for light. It is true that the last 10 years have seen a great extension of the uses of gas for purposes other than lighting—as a source of power, in the gas engine, cheaper and more convenient than steam; for domestic use, chiefly, though not exclusively, for cooking, which, for cleanliness, handiness and economy, is so superior to a coal fire that those who have once used gas for this purpose will not willingly do without it; for an almost infinite variety of manufacturing purposes in a great number of different businesses; and for heating by means of gas fires, which are in great demand. In all cases where a fire is wanted at short notice for a limited time, nothing is better or more economical than the gas fire; but it is rather more costly than a coal fire where it is used for all or the greater part of the day.

There does not appear to be scope for much improvement in manufacture, so far as turning out a better article is concerned. Most of the improvements have for some time been in the direction of a reduction of cost. In the matter of purity, there is very little more that can be done. Crude gas, as it comes from the coal in the retorts, contains many impurities—two or three of them in large quantities. Some are readily condensed by the simple operation of cooling, such as tar and water, which, in passing from the state of vapor into liquid, absorb and carry away considerable amounts of the gaseous impurities. These consist of sulphureted hydrogen, ammonia and carbonic acid, with some other compounds of sulphur, such as bisulphide of carbon. The most objectionable impurity, owing to its quantity and noxiousness—sulphureted hydrogen—is always absolutely removed. Ammonia also is so far taken out that nothing but the slightest trace is left—imperceptible to all ordinary tests; and of carbonic acid none remains. There is, however, an irremovable trace of sulphur in other forms or combination than sulphureted hydrogen; but this is reduced to a perfectly inappreciable quantity—to about 1 part in 2,000 parts of gas by weight. So small, in fact, is the proportion of this impurity left in the gas, that a delicate chemical operation, extending usually over 24 hours, is necessary—that is, the gas has to be burnt in a special manner for 24 hours—in order to discover the quantity contained in the gas. There are no known means for removing this last trace of sulphur; and there would be not the slightest appreciable benefit to the consumer if it were removed. In the matter of purity, therefore, nothing further needs to be or can be done.

It may not be out of place here to refer to a very common popular error while on the question of purity. The only so-called impurity of which the public complain is what is called smokiness, or, to use their own expression, "dirty gas," because in gas lighted rooms the ceilings become blackened sooner than in rooms where gas is not used. In the first place, I would say that, even where gas is not used, where a current of air impinges on a ceiling (as is the case in the neighborhood of hot water pipes), there the ceilings become, in a comparatively short time, as "black as your hat," due to the particles of dust contained in the air being driven by the air current on to the ceiling. In the case of gas, a current of air is driven straight on to the ceiling; and the air contains innumerable particles of dust, many of which are charred in passing through the flame. There is also the carbon of the gas itself, which, if it is not properly consumed, undoubtedly adds to the blackening effect. But the carbon is not an impurity; it is the life of the gas—in fact, it is the source of its light. To take out the carbon would be to render the gas non-luminous; and even with a non-luminous flame there would, for the reason above given, be a blackening of the ceiling, though not to the same extent as with luminous gas. Moreover, the greatest amount of light is obtained when the gas is on the verge of smoking. Therefore, those burners which overburn the gas, and develop little more than half the light obtainable by good burners, produce the least smoke, but such burners cannot be recommended.

The ideal method of burning gas is to convey the products of combustion entirely away from the room by means of a flue in the ceiling. If architects and builders would construct such flues, the most perfect ventilation could be attained by utilizing the heat of the gas for that purpose, and the gas would then not only give light, but would at the same time insure the removal of its own and of all vitiated air. Revert-

ing to the blackening of ceilings, it now appears—much to the surprise of a good many people—that the incandescent electric light, and even the wires when they are near the ceiling, will produce that effect.

This question naturally leads to the subject of burners. For a very long time—in fact, until between 30 and 40 years ago—very little thought or attention was given to this most important question. To give some idea of its importance, the cost of gas may, in effect, be doubled or trebled by unsuitable burners, and, on the other hand, it may be reduced to a similar extent by using those which best develop the light the gas is capable of yielding. About 40 years ago, Dr. Frankland showed that, the hotter the flame, the greater the amount of light; and it is by the application of this principle that the high lighting effect of the regenerative burners is produced. But the practical application of the principle enunciated by Dr. Frankland was not embodied in burners that the public could use, even in a crude form, until about 12 years ago, since which time many improvements have been made. It is, however, to Mr. Sugg (of gas burner fame) that gas companies and the public are mainly indebted for the improvement of ordinary burners. He showed that the most light was obtained from ordinary flat flame and Argand burners when the gas was burnt at a low pressure, and when the flame was on the verge of smoking. When London gas was consumed under these conditions, he obtained the light of 3 candles for each foot of gas burnt per hour—that is, a 5 feet an hour flame gave a light equal to 16 candles; whereas many of the old burners gave only 2 candles per foot, and some, when the gas was burnt at high pressure, would not afford as much as 1 candle light per foot of gas—or 5 candles, where 15 might be obtained.

The street lamps may be cited as a case in point. Before Mr. Sugg's improvements the light generally given by them was about half of that at present produced from the same quantity of gas. This great advantage was obtained by enlarging the diameter of the holes in Argand burners, and by increasing the width of the slits in flat-flame burners. This enabled the gas to issue in thicker streams; but it would only have caused a greater consumption, without much proportionate increase of light, had not governors or pressure regulators been introduced to reduce to a very low point the pressure at which the gas issues from the burner. The fishtail burners that were so common—in which there are two small holes in the center, placed at such an angle that two streams of gas on issuing impinge on each other, and spread out into a flat flame, in shape somewhat like the tail of a fish—need a comparatively high pressure to make the flame spread out properly; and for this reason they are the worst burners that can be used for London gas. I am glad to say they have fallen very much out of use, and should be discarded entirely, because they give the smallest quantity of light per foot of gas burnt.

In Mr. Sugg's improved burners, the principle enunciated by Dr. Frankland was adopted, by using non-conducting steatite instead of metal for the tips of the burners, thus consuming the heat of the flame. But this principle has now been carried very much farther in the regenerative burners, in which the heat produced by the combustion of the gas is used for heating both gas and air prior to combustion. This enormously increases—more than doubles—the light obtainable from a given quantity of gas. Forty years ago, many burners in common use did not give 1-candle light per cubic foot of gas burnt per hour, and very few gave more than 2 candles. By Mr. Sugg's improvements, this was increased to 3 candles (and rather more) per foot. The regenerative burners have raised the duty per foot of gas to 7 candles, according to an impartial authority—Mr. Dibdin, the Chemist and Chief Gas Examiner for the London County Council. Some of these burners give even higher results.

The latest improvement is, however, far in advance of any of the preceding; for its advocates claim that, for every foot of gas burnt per hour, a light equal to 20 candles can be obtained. But something must be deducted for its use in ordinary average conditions; and this it can well afford. Even then its effect will be about double that of the best previously attained. I refer to the incandescent gas burner, by which the light is obtained on an entirely different principle from that hitherto adopted. It is true that, strictly speaking, the light of an ordinary gas flame is due to incandescence—the particles of carbon in the flame being raised to a white heat. Consequently, the hotter the flame, and the longer the particles of carbon can be retained in the solid form, the greater the light. This is effected by causing the gas to issue in a comparatively thick stream, at a low pressure. The incandescence is, however, due to a component part of the gas itself—its light-giving quality, the carbon—whereas with the new incandescent burner the light is due solely to the heat-producing power of the gas, for which non-luminous is quite as good as, or better than, luminous, gas. The gas in this case is burnt with a mixture of air, on the principle of the Bunsen burner, giving a non-luminous flame. The burner is of the Argand form, and on it is placed a "mantle"—a piece of network in appearance like open woven cotton or lace, the size and shape of an Argand flame. This is heated to incandescence by the burning gas. This mantle is composed of various refractory oxides which are unaffected by heat, the composition of which, explained and illustrated, would, if practicable, form an interesting item in the Chemical Section of the lectures about to be delivered.

These successive improvements in the method of burning gas quite put into the shade, from an economical point of view, all other improvements in connection with coal gas. With the incandescent burner, gas at $1.50 per 1,000 cubic feet would be cheaper than gas at 25 cents per 1,000 feet burnt in a good fishtail burner, as fishtails go of 40 years ago; or, to put it the other way, with gas at 58 cents per 1,000 feet—its present price—the effect of the improved burners is practically to reduce the price to less than half or even one-quarter that figure.

The consumption of coal for gas making is about 12 million tons per annum in the United Kingdom. In London and its suburbs alone, it was 3¼ million tons in 1893, and the maximum quantity used in one day in the depth of winter in Greater London would be about 18,000 tons, or 750 tons an hour. Such figures, however, give no adequate idea of the quantity. I will therefore put it in another way, to show the extent of the business. One day's supply of coal of 18,000 tons would fill 6,000 3-ton wagons. Each with its pair of horses would occupy about 7 yards, or about 250 wagons to the mile. A train of such wagons a mile long would therefore give one hour's supply; and for the 24 hours, they would extend from London Bridge to some distance beyond Gravesend. To come closer home (I think the sixth milestone from London Bridge is somewhere near the farther end of Blackheath), one day's supply of coal for London, if put into such wagons, would make four lines along the whole of the Great Dover Road from Blackheath to London Bridge. They would, in fact, fill the road four deep for the entire length of 6 miles.

But the importance of the gas industry does not consist in its great extent, but rather in its usefulness and necessity to the community. In the first place stands the part it plays as a means of safety and protection. Evil does shun the light; and the evil prevented by the friendly gas lamp, although impossible to calculate, is none the less a very real and tangible benefit to the teeming population of this great city. The question may well be asked whether the population could have grown to anything like its present extent had gas lighting not been introduced. For this essential purpose of public protection, it is absolutely necessary that the supply of gas should be reliable; and it complies with this condition, for although—owing to local defects or accidents—a light here and there occasionally goes out, such a thing as the gas lights going out throughout any district is quite unknown. I never heard of such a thing happening in London—in fact, it can hardly be considered as possible. For instance, take the district in which we are now assembled. The Gas Company have six manufacturing stations, and every one is in direct connection with the entire network of mains—a network which is connected together at every possible point. It would be impossible to say at this moment whether the gas now before us comes from the East Greenwich or from the Company's other works on Deptford Creek, or from the works at Rotherhithe or the Old Kent Road; and if the supply from any of these works should be interfered with, the gas made at Vauxhall or Bankside could reach New Cross.

The managers of the gas undertakings are not unmindful of their duties and responsibilities to the public, and I think I can claim for them that those duties have been honorably fulfilled, and those responsibilities met, in a proper and satisfactory manner. The public need cheap gas, and this the companies do their best to supply. It is very doubtful whether the consumers would be as well served if the supply of gas were in the hands of the municipality, whose main object would be to charge as high a price as possible in order to get a large sum annually, out of the consumers, in aid of the rates—that is, the consumers of gas would pay more than their share of the rates. They would pay these directly, in the first instance, and then they would pay again indirectly in a higher price of gas than they ought to be charged. So far, however, as it is possible to forecast, there is no probability of the London Companies being extinguished; but there is a reasonable probability of a long and successful future. I hail, therefore, with satisfaction and pleasure, the course of lectures to be inaugurated to-night. The manufacture of gas involves so many interesting engineering and chemical operations, which, illustrated and explained as they will be by the able lecturers of this Institution, will not only prove a great advantage to all those who are engaged, or who hope to be engaged, in

the business, but will also be a source of information and pleasure to the users of gas and to all who are interested in industrial progress.

Mr. Lineham said they could not allow Mr. Livesey to leave them without heartily thanking him for his instructive address. It seemed to him that there was something more in it than appeared on the surface; and it would well repay thinking over. He agreed with Mr. Livesey's remarks regarding the control of gas works by municipalities. His (the speaker's) native town in Yorkshire was supplied with gas by a Corporation; and certainly there had been trouble ever since they undertook the work. It was astonishing that in a large town like Leeds the consumers had to pay as much for their gas as they did in south of London—58 cents per 1,000 cubic feet—although the cost of coal there was less than it was in London.

Mr. Bloxam seconded the motion, and the Chairman supported it, remarking that the fact that an address of this character had been so greatly appreciated was evidence of the advantages of an Institute such as that in which they were assembled.

The motion having been cordially passed,

Mr. Livesey, in responding, observed that the question of the supply of gas of London or any of the large cities and towns was one of great importance, and well worthy the attention of all. Gas was not played out, nor was it going to be. One thing that had struck him very much in preparing the address was the very long time that elapsed between the discovery of gas and its practical application. Only very recently it had taken a fresh start, and its greater application now was truly marvelous. Until lately very few of the working class had used gas; but Mr. Brownhill, of Birmingham, a few years ago, conceived the idea of applying the principle of the penny-in-the-slot machines to the supply of gas. The system had since been taken up to an almost astonishing extent. In the case of the South Metropolitan Gas Company, they were now receiving nearly 500 orders a week for these meters from new consumers—at any rate, 450; and in about two years 20,000 consumers had been connected with their mains, and supplied on this system. In the comparatively small town of Tunbridge Wells, too, where the Gas Company had previously about 2,400 ordinary consumers, they had in one year increased the number by nearly 50 per cent., or, in other words, they had obtained 1,000 new consumers. This showed that gas was required by the poorer class of people, and that, when it was placed within their reach, they appreciated it. In conclusion, he intimated that, if the gentlemen who were responsible for this course of lectures would like to take the students to one of the stations of the South Metropolitan Company, every facility should be afforded them for inspecting the plant.

Bouvier's Siphon Test-Box for Gas Mains.

On the 2d inst. U. S. Letters Patent (No. 526,852) were granted to Mr. Adolphe Bouvier, of Lyons, France, for an invention the object of which is a siphon test-box for detecting leaks in gas mains. Using the words of the specification:

The apparatus is shown in the annexed drawings, in which Fig. 1 is a vertical section along the axis of the dipping pipe. Fig. 2 is a vertical section along the axis of the dipping pipe and at right angles to the preceding figure. Fig. 3 is a plan.

In the figures, *A* is a siphon receptacle or box of metal, usually cast iron, connected to the gas main by means of two tubes a a^1. The inside chamber or box *A* of the siphon is U-shaped, as shown, being divided into two separate parts by a partition a^2 cast with the box. *B*, *C*, *D* are three vertical tubes. Each of these tubes *B*, *C*, *D* receives a pipe marked with the corresponding small letter *b*, *c*, *d*. b^1 is a pipe fixed in the central tube *B*. This pipe is a prolongation of the pipe *b*. It is beveled at its lower end, which dips to the bottom of the box *A*. I call it the dipping pipe, and it serves to introduce water into the siphon. The tubes *C* and *D*, with their respective pipes *c d*, serve for the passage of gas when testing the tightness of the mains.

E is an inspection box with a cover *e*, beneath which I place my siphon. *F F* is the ground line. f, f^1, f^2 are screw caps for the pipes *b*, *c*, *d*, having generally a triangular or other shaped head. g, g^1 g^2 are grease cups, which, like the caps, are preferably of inoxidizable metal. *H* is a horizontal plate connecting the three tubes *B*, *C*, *D*. *h* is a similar plate receiving the pipes *b*, *c*, *d*, and which is fixed to the plate *H*.

I, *J* are the lateral tubes or junction pieces which serve to connect the siphon to the main. *K* is a plug in the bottom of the box.

Leaks are searched for in the following manner: A given section of the main comprising part of a street, or even several neighboring streets in the same quarter being isolated from the rest of the system by means of one or more siphon boxes previously filled with water, as shown in Fig. 1, I bring up a portable gasometer of ordinary construction mounted on wheels, which is not shown in the drawings.

It is assumed that the siphon has been filled with water, as indicated in Figs. 1 and 2, and that the pipe a, and consequently also the tube *C* and pipe *c*, communicate with the side where the gas is supplied freely

Fig. 1.

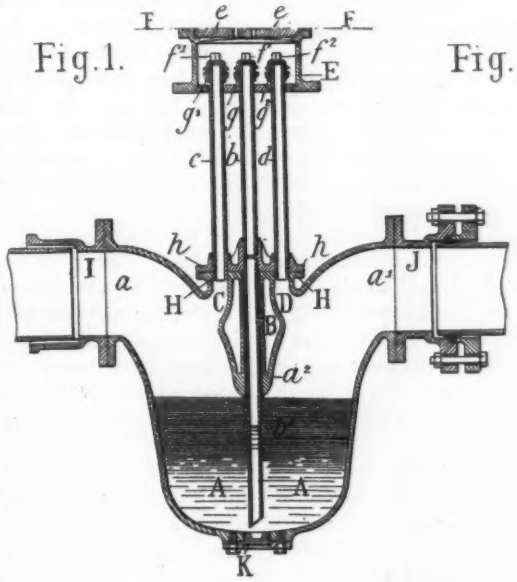


Fig. 2.

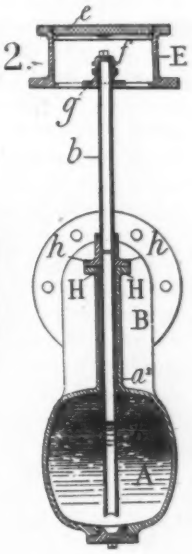
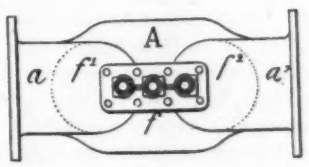


Fig. 3.



from the gas works under the usual daytime pressure of gas—for example, 20 millimeters of water—and that the pipe a^1, and consequently the tube *D* and pipe *d*, communicate with the isolated section. I close all the supply branches from this section, ceasing, therefore, to supply gas to the consumers of this section. This interruption does not last more than half an hour, and only takes place once or twice a year. I connect the supply pipe of the gasometer by an india rubber pipe with the pipe *c*. The bell of the gasometer rises, owing to its flotation, and is filled with gas at a pressure of 20 millimeters. When it is full I close the supply pipe *c* and connect the exit pipe of the small gasometer with the pipe *d* of the siphon, and thus with the section to be tested. Sufficient weights are placed on the bell to give the gas it contains a considerable pressure for the test—say 100 millimeters. I introduce this gas under pressure into the isolated section, and the bell first descends a certain distance by reason of this. Afterward if there are leaks in this section the bell descends at a rate proportional to the size of the leaks. I note how many liters of gas escape per minute from each section under the testing pressure of 100 millimeters. I am thus enabled to know in figures the relative tightness of each section under conditions which augment the sensibility of the test and the precision of the measure. I know where the leaks are, and their importance. It is thus easy to repair them.

This siphon test-box also serves as an ordinary siphon for receiving the condensations from the gas, as a connecting piece for the mains, and as a hydraulic stop valve for closing the passage for the gas under any circumstances, for example, in case of accident, fire or explosion, repairs, etc.

Fire from Contact with Electric Wires.

By Mr. William Brophy.

The topic I have chosen for discussion, as you may suppose, is one which has not been treated in detail by me in previous papers. The points I propose to discuss will be the danger of fire due to the contact between electric wires carrying currents that are capable of causing personal injury or igniting any substance with the possible exception of highly inflammable gases or other equally volatile substances, and wires carrying currents sufficient in quantity and propelled by a sufficient force or pressure to overcome the resistance of any system such as telegraph, telephone, district messenger, and last, but not least, the fire alarm telegraph.

While contact between the dangerous class of wires (which name, for

convenience, I will apply to all wires except those carrying messages and signals), and low tension wires other than those of the fire alarm system, may result in fire as well as personal injury and loss of life, the means of communicating with the fire department is not cut off.

When the heavier currents escape to the low tension wires the first effect thereof is felt in the fine wires of the various instruments, such as telegraph relays and sounders, telephone transmitters, call bells, etc., and any other instruments in which electro-magnets are used.

In order to produce the necessary magnetic effect the wire which forms a constituent part of these magnets is very fine, and unable to carry any but the weakest form of current without heating. For this reason the passage of a high potential current in any considerable quantity through them invariably results in destroying the insulation which consists of a covering of silk or cotton thread that is apt to be quickly burned by the overheating of the wire itself.

When an abnormal flow of current reaches an electro-magnet it is suddenly checked by the high resistance of the fine wire. Heat is quickly developed therein, but as it is wound compactly on the spools, the insulation, instead of quickly bursting into flame, is slowly carbonized, when it becomes a good conductor of electricity, thus changing the course of the current from around and through the convolutions of fine wire several hundred feet or more in length, to a more direct and shorter course from one convolution to another by means of the carbonized insulation.

The effect of this in most cases is to increase the flow of current to such an extent as to overload the ends of the fine wires leading to the binding posts or other connections with the larger wires, and cause them to melt or vaporize, thus opening the circuit. This is due to the reduced resistance of the magnets through the carbonized insulation.

When currents of high voltage or pressure are passing over the line there is danger after the circuit is opened in this manner of the current forcing a passage or jumping over the space where the wire enters and leaves the instruments, in which case fire is pretty apt to be communicated to surrounding objects of an inflammable nature. Where currents of high potential and small volume pass over the line this result is not so apt to follow.

To illustrate this more fully, let me say, as you all know, that while it is easy to force a ¼-inch stream of water across a street 60 feet wide under a sufficient pressure or head, it would be next to impossible to force one the same distance the size of an ordinary pipe stem, no matter how great the pressure behind it might be.

The pressure necessary to produce light in a circuit containing 50 arc lamps of 2,000-candle power is about 500 volts. The amount of current required for this or any greater number of lamps in series on any one circuit is about 10 amperes (units of quantity). While this amount of currents is sufficient to burn or carbonize the insulation of and melt the fine magnet wire, it does not, under all circumstances, cause fire. I have frequently connected the ends of a piece of No. 14 copper wire to the positive and negative sides of a circuit that contained 50 arc lamps. This piece of wire, including a telephone transmitter, formed a short or derived circuit for the current to travel over. The resistance of the lighting circuit, including the lamps, being 250 ohms (units of resistance or friction), while that through the transmitter was but 100 ohms. The effect when this derived circuit through the trans mitter was closed was to divide the current, about four parts going through the lamps and six parts through the transmitter.

In every case the fine wire was melted off, thus opening the circuit before a sufficient amount of heat was developed to ignite the wooden case of the transmitter. If the lamp circuit were opened at the same time the current was turned through the transmitter, the result might and probably would have been different, and damage to the surrounding woodwork might be the result; but in this case after the derived circuit through the transmitter was broken the entire current could pass through the lamps.

Were an escape of current to the earth, technically called a "ground," to occur on any part of this lamp circuit, which like all electric lighting circuits is metallic its entire length, not using the earth as a return path to the dynamo as most telegraph, telephone, street railway and some other lines do, a contact at any one point of any circuit just named would have about the same effect as the double contact above described.

From the results of the experiments and from the results of very many burn-outs of transmitters and call bells, due to contact between the outside wires of electric lighting and telephone circuits during the prevalence of high winds, snow and sleet storms, it is quite evident that danger of fire being communicated to surrounding objects is somewhat remote.

The next source of danger is from the wires of the direct current incandescent system. These, like the arc lighting circuits, are metallic.

The 3-wire system is usually used for the transmission of the current, and the pressure in the outside wires is from 220 to 230 volts throughout the entire system, except 2-wire branches in the interior of the building lighted, in which the pressure is from 100 to 110 volts. The total output of current, however, varies with the number of lamps.

In this system the dynamos are connected together so that they deliver the current into one common set of conductors from which radiate other conductors and wires to the different points where light and power are to be supplied.

In the city of Boston, for instance, there are about 79,000 incandescent lamps, not including arc lamps and motors, supplied from the three stations of the Edison Illuminating Company, and all are connected to one system of conductors.

This number of lamps alone requires 35,550 amperes of current and over 5,000-horse power.

It is needless to say were this or a small fraction thereof concentrated on any one magnet or small wire that they would be quickly destroyed and fire would follow.

The total length of conducting wire used in this plant is 1,148,777 feet; fortunately all but about 9,000 feet of this is under ground, and the great danger from contact between these and the wires of other systems is nearly eliminated.

The copper conductors are placed in wrought iron pipes and surrounded with an insulating compound; these pipes are then placed in the ground.

To show the enormous amount of heat that can be developed in this system you need only to be told that it often happens that sections of this pipe are melted, vaporized, together with the large copper conductors they contain, when from any cause the insulation fails and the conductors are, to use a technical phrase, "short circuited." Cases of this kind have occurred where the heat became so intense that it caused the paving stones to crack and crumble like lumps of coal in a furnace. Contact between these and ordinary low tension wires, as you can plainly see, is very dangerous and might be a fruitful source of fire. The matter of expense is the only obstacle to placing these wires under the ground.

The next system of wires to be considered, and the most to be dreaded, are those of the street railway using electricity as a motive power. As nearly all of these use the earth as a part of their circuit, and the trolley wires are of necessity bare, the chances for contact with other wires are very much increased, and in the case of wires using the earth as a return, but one point of contact is necessary to establish a flow of current over the derived circuit thus formed. The pressure is 500 volts and the current is in proportion to the number of cars in use.

A street car with motors of 30-horse power requires 22 amperes of current; sufficient in quantity if directed over the ordinary copper wires, from No. 18 to No. 14, to overheat them and burn the cotton covering that is rendered still more inflammable by being treated with paraffine. It is needless to add that the fine wires of electro-magnets would quickly succumb to the heat developed by this amount of current.

There are very few roads that do not require more than one car for the accommodation of its patrons. Where 50 and 100 cars are run, the menace to property from this source is of a serious nature.

Experiments with street railway currents show that they will maintain a destructive arc or flame over a much greater space than will those of arc or low tension incandescent systems of lighting, and that safeguards that are very reliable in the case of the latter are worthless when applied to the former.

There are other dangers connected with street railroad currents that are of vital importance to cities and towns that depend on a system of water works for protection against fire, that I will not attempt to deal with at this time.

Next comes the alternating or transformer system of electric lighting, in which a primary current of 1,000 volts pressure is generated at the dynamo and conveyed over a system of conductors to transformers or induction coils wherein a secondary current of 50 volts pressure is generated and conveyed to the lamps.

The volume of the primary or inducting current is but $\frac{1}{20}$ of the secondary or lighting current. A 3,000-light dynamo will deliver 150 amperes to the lights. The current in the primary wires would, if diverted from its path to any of the small wires of the systems using the weaker currents, maintain a destructive arc over a much wider space than would that of either of the systems before mentioned.

The usual safeguard relied on to prevent an abnormal flow of current

is the safety fuse; the melting point being low enough to prevent the overheating of the wires they are designed to protect. They are universally used in all incandescent lighting, power and electric railway circuits to prevent the overheating of wires, burning of wires, burning out the motors, etc.

These should be placed in the wires they are to protect, as near the point where they enter and leave the buildings as possible, and they should be mounted on non-combustible bases, and be of sufficient length to prevent an arc between the terminals.

There are also electro-magnetic devices designed to perform the same functions of the safety fuse, but many of them are of doubtful utility.

While the fuse is not an absolutely perfect safeguard, it is a great step in that direction, and is very reliable when properly proportioned. That they sometimes fail is true, as proved by my own experience; but when we consider that millions of them are in use, they must be considered very reliable in spite of an occasional failure.

I will at this time cite but one instance of the failure of safety fuses which has recently come to my notice, and as it affected a device designed to protect the building in which it happened, it is all the more remarkable.

Many of you, no doubt, are familiar with the thermostats or automatic system of fire alarm installed in thousands of buildings, where a rise in temperature to about 165° F. at the thermostats causes them to close the circuit and send the alarm to the fire department.

Chief Marston, of Brockton, informs me that a fire occurred in a shoe factory in that city recently that is equipped with one of these systems, due to a contact between the wire extending to fire engine house and an incandescent electric light wire. The wire of the automatic fire alarm was grounded purposely to complete the circuit, and the electric light wire accidentally.

The fire alarm wire was provided with safety fuse where it entered the building, and yet the cotton burned off by the heating of the wires due to an excess of current. Fire was also communicated to the building, but fortunately caused but little damage.

This is a case where the fuse was not properly proportioned to the self-carrying capacity of the wire. Mistakes of this kind are to be carefully guarded against.

While the safety fuse and other devices are designed to open the circuit and prevent overheating the same or the instruments connected to it, they are not adopted for general use on fire alarm circuits unless they can automatically close them when the danger is passed.

The reason for this is obvious. The continuity of a fire alarm circuit is of the greatest importance, as any break or interruption of the same renders it inoperative, thus preventing in many cases the sending in an alarm of fire from the territory covered, resulting possibly in great loss by fire.

The breaking of the fuse through lack of mechanical strength from mechanical injury, excess of current, or lightning discharges, opens the circuit and leaves it so until fuses are replaced. For this reason an attempt to protect the boxes, gongs, bell strikers, indicators, etc., with the exception of the office instruments (where fuses can be quickly replaced) in this manner is of doubtful expediency.

Any device for the protection of fire alarm systems against an excessive flow of current should not open the circuit, but should introduce a sufficient amount of resistance to prevent such a flow and at the same time maintain the efficiency of the current; this resistance to be introduced automatically and removed in the same way when the danger is passed.

I find an impression prevails in the minds of a good many Chiefs and Superintendents of fire alarm, that in order to divert any portion of the current from one metallic circuit to another, it is necessary that one or both should be grounded. Such is not the case, however.

If a fire alarm circuit or any portion of it comes in contact at two different points of a metallic electric light circuit, current will surely flow over the former from the latter, providing its resistance is less than that of the electric light circuit, or that portion of it included between the two points of contact.

The State of Massachusetts has a law on its statute books compelling the attachment of safety devices to all electric wires that enter buildings, although such wires are perfectly harmless; but they might be, and have been, rendered dangerous in the manner I have described.

My object in presenting this topic is to show the great importance of compelling the owners of wires that are not considered dangerous to equip them with proper safety devices that prevent them from becoming so and starting incipient conflagrations.

While it is our aim and duty to extinguish fires after they have been discovered, and while assembled here to discuss the best means of doing it, yet I believe we should do all we can to prevent their origin; and if the preparation and presentation of this topic results in the enforcement of this very reasonable request, and thus indirectly aids in preventing a portion of the millions of shameful waste that is continually going on by conveying that amount of valuable property to the national ash heap and dumping ground, it will have accomplished all that I could reasonably expect.

Municipal Electric Lighting.

Mr. E. C. Breithaupt, at the last meeting of the Canadian Electrica Association, read a paper on the subject named in the heading, from which we abstract the following:

It is the purpose of this paper to consider the question of government ownership of natural monopolies only in so far as it concerns works for the supply of artificial light, and particularly such as is wholly for the public use—viz., the lighting of streets and public buildings.

It is proposed that these works be owned and operated by the municipal corporation, and many cities and towns have been considering the advisability of the plan. The question has been hotly argued on both sides, and it is to be regretted that these discussions are not always conducted in a fair-minded, liberal manner. Arguments advanced by men interested in private lighting companies are denounced by their opponents as prejudiced opinions; the cry of "monopolist" is raised to enlist public favor on the side of municipal ownership, and the same offense is thus committed as is charged. It is but natural that persons having capital invested in any particular enterprise should strive to protect their investments, especially in a case of so serious a nature where the threatened danger means inevitable destruction. On the other hand there is much to show that the arguments put forth by the advocates of municipal ownership are not always inspired by pure and unselfish motives.

If these discussions are to accomplish any good the opinions advanced by either side must be honest and unbiased, and, above all, the facts and figures cited must be truthful, for the outcome of the case really hinges thereon.

The burden of proof lies with the advocates of municipal ownership, and the arguments in favor of their claim are identical with those of the complete scheme of government ownership.

Can a municipal corporation perform its own lighting service cheaper than a private company can supply it? Figures are given showing the cost of the service where the plant is owned and operated by the municipality, and estimates are made on the cost of building and operating proposed plants, nearly all of which are so surprisingly low that they must at once arouse suspicion in the minds of thoughtful men. According to these reports the cost of public lighting, where it is done by the municipality, averages about one-half of the price usually paid to private companies. One town in Illinois, having 120 electric lamps on its streets, even reports that these cost nothing, that the expenses of operating are all paid by the profit received from commercial lighting. It is a significant fact, however, that these figures rarely represent the actual total cost. There is a tendency on the part of the advocates of municipal ownership to underestimate or entirely ignore any items which are not cash actually paid out, such as depreciation in value of plant due to wear and tear, and to the fact that new and improved apparatus and methods are constantly coming into use, interest on capital invested, insurance, taxes, and in some cases water supply. The town treasurer's statement of expenditures incurred in operation is often the only outlay considered, and even this may be incomplete, since municipal authorities do not always analyze accounts so as to show a full statement for each department. Insurance and similar expenses may be debited to separate ledger accounts and not appear at all in the statement of a particular department. Other items are charged to the department where they belong, but under the wrong heading. As a case in point, we may cite the financial statement of Toronto Junction for 1893. Under receipts and disbursements authorized by by-laws for issuing debentures on account of electric light construction, we find an item for rebuilding engine bed of $162.93. This was a repair and properly belongs to maintenance.

Now, it is plainly unfair to compare such figures with those paid to private companies and say that a municipality operating its own plant saves the difference. To compare results intelligently we must agree on a basis of comparison. If the price paid a private company is remunerative to them, it includes depreciation, interest, insurance and taxes, and we must therefore debit a municipal plant therewith. The municipality may for a number of years persuade itself to believe that these expenses are imaginary, but it must meet them in the end, and no

matter to which account they are charged they are incurred by the lighting plant.

Many cities and towns have been persuaded by incomplete reports and alluring statements to undertake the experiment, but it still remains to be proven that a municipal plant can supply a cheaper light than a private company. In towns which are not large enough to make the business remunerative the installation of a plant by the corporation may be justified, because street lighting is a public necessity, but where private plants already exist that are able and willing to supply the municipality at a fair price, the outlay cannot be regarded otherwise than as an unnecessary expenditure and waste of public money.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

ON the 1st of November the business offices of the Penn Gas Coal Company will be located in the Reading Terminal Building, northeast corner of 12th and Market streets, Philadelphia, Pa. The elevator entrance is on 12th street, above Market.

THE Alton (Ills.) Electric Street Railway Company has purchased the plant and franchise of the Alton Gas and Electric Light Company, and will operate the same. Mr. Beck, the present Superintendent of the lighting Company, will be retained.

MR. WILLIAM MAINLAND, whose management of the gas plants at Oshkosh and Fond du Lac, Wis., has been marked by tact and with success, has also assumed charge of the Racine (Wis.) Gas Company. While the three places named seem to constitute a task of no mean proportions, Mr. Mainland can be safely counted on to do justice to his employers and to give satisfaction to the gas consumers of these three pretty and growing Wisconsin cities.

A CONTRACT that was completed in marvelously short time is that recently finished by the Goodwin Meter Company, in its construction of a 14-foot meter on the 25th ward station of the Philadelphia gas works. The Company also reports a good line of work in hand for photometrical apparatus, etc. Late orders of this sort include a 60-inch photometer for the New York and East River Gas Company, and a 5-foot meter prover for the same purchaser; a 100-inch bar photometer for the Milwaukee (Wis.) Gas Company; a complete set of photometric and testing apparatus for the official gas inspector (Mr. A. D. Meeds) of Minneapolis, Minn.; and a photometric and testing outfit, complete, for Mr. Charles Krecke, official gas inspector for Detroit, Mich.

THE death of Mr. Francis Buttrick, of Waltham, Mass., occurred in that city on the morning of October 8. Deceased, who was largely interested in the Waltham Gas Company, was born in Pepperell, Mass., in 1814, and settled in Waltham in 1854, where his career was one of unbroken success.

WE are indebted to a Chicago correspondent for the following, under date of October 11th: "Ald. O'Neill read a letter to his colleagues in the Evanston (Ills.) City Council, at its last meeting, and the residents of that place are talking about it still. The letter purported to offer to give him $70,000 worth of the stock in a proposed opposition Gas Company if he would secure the passage of a franchise. The letter suggested that the Alderman could retain $50,000 of the stock, placing the other $20,000 where it would do the most good. The letter bore the Chicago postmark, and had a stamped signature of the supposed agents of the gas syndicate. From the fact that the Company had not been incorporated it appeared that the men interested in the deal were dependent on the actions of the Council. The letter was referred to City Attorney Baker and the members of the Judiciary Committee, who were instructed to investigate the matter thoroughly. Ald. O'Neill says that he made public the attempt to bribe him because of the unwarranted criticism which the had been made to bear in consequence of his attitude towards the proposed Company. The original ordinance, which was introduced into the Council last June for the granting of a charter to a new Gas Company, bore the following names as its promoters: H. R. Post, Wm. Newell, D. F. Hamlick and W. J. Moodie. They failed to agree to a proposition to deposit $25,000 as an evidence of good faith, and would not specify who were the stockholders or what system they intended to use. The Committee thereupon determined upon an adverse report."

MR. WALTER E. NORTHRUP, President of the Oneida (N.Y.) Gas Light Company, has been nominated for Congress by the Democrats of that district.

THE East Portland (Oregon) Gas Company will discontinue manufacturing on the East Side, the supply of the latter place to be carried on by means of a main laid under the river, and connected with the West Side works.

THE proprietors of the Plainfield (N. J.) Gas and Electric Light Company announce a reduction in the selling rate on the following basis: From $2.20, gross, per 1,000 cubic feet to $2 per 1,000, with 10 per cent. off for prompt payment.

OUR last issue contained a brief announcement to the effect that the Board of Gas and Electric Light Commissioners had, as a result of their hearing on the petition of Mayor Marsh and other residents for a cheaper gas rate in Worcester, recommended the Worcester Gas Light Company to make a concession of 15 cents per 1,000. The official records in the premises are appended:

COMMONWEALTH OF MASSACHUSETTS, IN BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS, BOSTON, Oct. 8, 1894.

On the petition of Hon. Henry A. Marsh, Mayor of the city of Worcester, for an equitable adjustment of the price of gas to be furnished the city and its inhabitants by the Worcester Gas Light Company, it was

Voted, that the Board recommend that the net price of gas supplied on and after November 1, 1894, to the consumers of the Worcester Gas Light Company, shall not exceed $1.25 per 1,000 cubic feet.

Voted, That the Directors of the Worcester Gas Light Company be requested to take action on the adoption of the foregoing recommendation and transmit to the Board a certified copy of such action on or before October 31, 1894, and that the Clerk of the Board be directed to transmit to said Company a certified copy of the foregoing recommendation and vote thereon. J. T. LEARY, Clerk.

COMMONWEALTH OF MASSACHUSETTS, IN BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS, WORCESTER, Oct. 8, 1894.

In the matter of the petition of Hon. Henry A. Marsh, Mayor of Worcester, to this Board for an equitable adjustment of the price of gas to be furnished the city and its inhabitants by the Worcester Gas Light Company. After due consideration of the testimony at the hearing at Worcester July 13, 1894, and a careful examination of the returns of said Company for the year ending June 30, 1894, the Board is of the opinion that the Worcester Gas Light Company can furnish gas at the net rate of $1.25 per 1,000 cubic feet, without injury to the interests of its stockholders, and therefore recommends that the net price of gas supplied on and after Nov. 1, 1894, to consumers, shall not exceed $1.25 per 1,000 cubic feet. For the Board, C. H. GIFFORD, Commissioner.

ON the 9th inst. the Directors of the Worcester Gas Company met to consider the recommendation of the Commissioners, and agreed to accept the decision. It was voted that the rate be reduced to $1.25 per 1,000, which rate should be the same to all, whether accounts are settled promptly or not. It is worthy to note in this connection that although the gross rate in Worcester last year was $1.70 per 1,000, the net rate for prompt payment being $1.40 per 1,000, the average price of all the gas sold by the Company was $1.50 per 1,000.

WE are sorry to have to say that ill health impelled Mr. Henry C. Rew to resign from the Presidency of the National Gas and Water Company, of Chicago. His son, Mr. Irwin Rew, the Company's Treasurer, was elected President.

A CORRESPONDENT forwards the following, under date of the 15th inst.: "Last week a question of interest to all gas consumers of Baltimore was brought before the courts, involving the right of the agent of the Gas Company to enter the premises of a consumer if the latter offers an objection to such an entrance. The bill was filed by the Consolidated Gas Company against Mrs. Eleanor G. Fox, who lives at 2227 Oak street. The Company claims that Mrs. Fox made a contract with the Chesapeake Gas Company, of which the plaintiff Company is the successor, October 22, 1887, by which she agreed to pay all bills for gas used in her house. This contract contains the usual provision to the effect that the Company's workmen shall be at all times allowed to examine the meters and connections or to remove the meter. The Company claims that it has at all times performed its part of the contract, but that in March, 1893, Mrs. Fox refused to pay her bill, or to allow an employee of the Company to examine her meter. Legal proceedings were instituted, the meter was replevined and judgment for amount of bill was received and paid. It is necessary, the Company alleges, for the protection of the lives and health of the residents of the house, and

for the protection of the Company, to see that the pipes are in good condition, and it is customary to make such examination every six months. This Mrs. Fox refuses to allow, and now the Company asks that the agreement be specifically enforced and a decree signed allowing workmen to enter the house and make any repairs on the pipes they may deem necessary. Thus it will be seen the real question is whether the Company's workmen have the right to enter a house after the gas meter has been removed."

THE Delaware County Gas Company, of Chester, Pa., in consequence of a marked increase in output, will erect a holder on the Tilghman street site, rated to store 200,000 cubic feet.

THE arbitrators appointed to appraise the value of the plants of the Moncton (N. B.) Gas Light and Water Company, which are to be taken over by the town, for operation hereafter on municipal account, have reported the worth of same at $350,000. Mr. Shanley (who represented the town in the arbitration) did not agree with his colleagues; and, strange to say, he is reported as believing that the sum allowed should be figured at $400,000. Before going into the arbitration the town offered the Company $180,000. The town bears all the expenses of the arbitration court, and it is estimated these will not fall short of $25,000.

PRESS despatches are to the effect that judgment has been given in the case of Hugh D. Cann and others, of Yarmouth, N. S., vs. Robert S. Eakins, E. F. Clements, E.W. Clements, A. M. Perrin and Linus M. Child, Boston and New York capitalists, for $48,000, in favor of the plaintiffs. The action arose out of an amalgamation of the Yarmouth Gas Light Company and the Yarmouth Electric Light Company. The plaintiffs, who were shareholders, claimed that the defendants, who were Directors of the Gas Company, fraudulently procured a controlling interest in the stock of the Gas Company, and then purchased the electric light plant, owned by themselves and their friends, at an exorbitant price, the result of which was that the interest of the plaintiffs in the stock and property of the Gas Company was wholly lost.

THE General Term of the Supreme Court, in an opinion written by Judge Follett, has affirmed an order vacating the assessment which was placed by the Commissioners of Taxes and Assessments on the personal property of the Equitable Gas Light Company, of this city, for the year 1893. The capital stock of the Company is $4,000,000. The value of the personal property of the Company liable to assessment was fixed by the Commissioners at $1,972,700.

MR. DAVID J. JOHNSTON, President of the Cohoes (N. Y.) Gas Light Company, died in Quebec, Canada, on the morning of the 12th inst. His death was quite unexpected, as will be understood when it is said that, in company with his wife, he was visiting some friends in Quebec when the summons came. Deceased, who was one of the most prominent citizens of Cohoes, was born about 60 years ago in Columbia County, N. Y., and early in life established himself in Cohoes. Some years ago he became the General Manager of the Harmony mills, and in 1872 he was elected Mayor of the city, being chosen for the same office in 1876. He served on the Board of Aldermen for many years. At the time of his death he was President of the Cohoes National Bank, a Trustee of the Cohoes Savings Institution, President of the Cohoes Gas Light Company, and a Director in many other local enterprises. He was actively interested in religious work. The survivors of his family are his widow, two sons and a daughter.

A SPECIAL meeting of the shareholders of the Montreal Gas Company, was held to "confirm or reconsider, or otherwise deal with the increase of the Company's capital stock, as decided upon at the last annual meeting." At the meeting it was decided to put the increase in capital stock upon the market, but, as it was uncertain whether they had the power to do so at the time, the special meeting mentioned was called for the purpose of confirming the decision or otherwise. Mr. H. S. Holt occupied the chair. The other Directors present were Messrs. Robt. Benny, J. P. Dawes, N. A. Hurteau and Hector McKenzie, while among the shareholders attending were Messrs. John Crawford, Verdun Ed. Holton, M. Burke, W. B. O. Reddy, A. S. Ewing, John Patterson, T. E. Vasey, J. Dunlop, Louis Armstrong, G. N. Moncel, James Hutchison, G. W. Kinghorn and A. W. Atwater. Mr. Crawford said that although he was of the opinion that the Directors had acted to the best of their ability in the buying out of the Consumers' Company, yet it would have been his policy to fight till the last. Mr. Holt, the President, agreed with Mr. Crawford in many of the things he had said, but he added that if they had fought the fight might have lasted some five years; and as the stock was held in many cases by widows and children, who were depending upon its dividends, that circumstance had to be taken into consideration. The shareholders, too, would have felt more sore about it than they did now. Mr. Holt went on to say that the members of the City Council were the only people to blame in the matter for allowing it to start. It was the experience the world over, he said, that no two companies could supply gas in the same street for any length of time, for one always bought out the other, or something of that kind. Besides, the Consumers' Company would only be having a small loss, supplying as they did a smaller amount of the gas while their Company would lose more largely in supplying a greater amount. "Take New York as an instance," said Mr. Holt. "In some streets there are 16 pipes laid by 16 different companies starting. The Consolidated Company is supplying gas in New York city at $1.25, and they can afford to give it cheaper than we can here." In answer to another question, Mr. Holt said there need be no fear of another Gas Company starting, as the City Council had now more sense. Mr. A. W. Atwater's opinion was that the Directors had done the best thing possible, and were only to blame in not doing what they had done a year ago. The following motion, proposed by Mr. J. P. Dawes and seconded by Robt. Benny, was then carried:

Resolved, That the increase of the capital stock of this Company, from 2½ to 3 million dollars, as decided at the meeting held on the 5th April last, is hereby confirmed, and that the additional $500,000 be offered to the public by admitting new members at market prices and paying to the Consumers' Gas Company the purchase price of their gas works, etc. The whole at the discretion and as may be decided by the Board of Directors.

THE Ohio Electric Gas Company, of Springfield, Ills., to manufacture gas machines, has been incorporated by Messrs. H. Clay Wilson, John G. Friedmeyer and Benjamin Knudson. The capital stock is $250,000.

THE Western Gas Construction Company, of Fort Wayne, Ind., has been awarded the contract for the equipment of the Oskaloosa (Iowa) gas works with an improved Lowe water gas apparatus, the same to have a daily capacity of 150,000 cubic feet. Besides the generating apparatus, the contractors will furnish the necessary auxiliary plant, which in this instance comprises an iron floor, a boiler, an oil storage tank of 10,000 gallons capacity, and a set of 10 by 12 purifying boxes. It is worthy of note that the Oskaloosa contract is the third one obtained by the Construction Company for its improved type of Lowe water gas apparatus within a month.

THE Board of Gas and Electric Light Commissioners will shortly meet to consider the petition submitted by the Municipal Lighting Board, of Wakefield, Mass., now in control of the Citizens Gas Light Company, the plant of which was recently taken over, to be operated on municipal account by the ratepayers of Wakefield. The petition is as follows: "The Citizens Gas Light Company, having its plant at Wakefield, furnished gas to the inhabitants of Wakefield and also to the adjacent towns of Stoneham and Reading, and at the time the town of Wakefield took possession by decree of the Court, of the plant and pipes in the town of Wakefield alone, it left the towns of Stoneham and Reading without a supply of gas. In order that the Citizens Gas Light Company might keep its charter alive the Company arranged with the town to supply gas through its pipes to Stoneham and Reading, until October 1, 1894. The inhabitants there agree to pay the regular price for gas according to the reading of the meters. This contract the town has carried out. There was a feeling, however, that there was a considerable loss of gas by leakage, and we arranged to put in meters at the town lines. We find there is now quite a loss. While the Company is desirous of having the town furnish gas for a few more months to Stoneham and Reading, the town is not disposed to furnish gas unless it can have pay for it as supplied. And to this end we would like to furnish them gas according to meters as taken at the town lines at $1.60 per 1,000. In this way the town would be better paid than to furnish gas at meter measures at $2. The town has been obliged to take the plant, the court fixing the price, and it cost, with additions, in the vicinity of $170,000. If the town was compelled to figure the interest on the cost of the plant and a percentage for depreciation, and any fair price for lights used by the town, and undertake to get from the users enough to pay for the gas and electricity to make up the deficiency, the price would be such as to prohibit entirely any sale. So the Board recommended to the town that there be no change in the price of gas, and to remain at $2 to ordinary users, or $1.80, if paid for in 10 days, and $1.60 to mechanical users with separate meters. They recommended for electricity 1 cent per lamp hour for 16-candle power, and that they have a fixed charge per month of say $1, if the meter reading was under $1. If the prices we have outlined are approved by the Board of Gas and Electric Light Commissioners we will be able to do some business."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR - Jos. R. Thomas, C.E.
ASST. EDITOR - T. J. Cunningham.
MANAGER - C. E. Sanderson.

MONDAY, OCTOBER 22, 1894.

The Market for Gas Securities.

The quotations for city gas shares are practically unchanged, the figures of to-day (Friday) for Consolidated being identical with those given last week. The financiers and engineers connected with the New York and East River Company assure an anxious public that they will shortly "blow out" their pipes, preparatory to supplying gas in the near future. It is also so that the Company's canvassing department is offering prospective consumers gas for $1, and even 90 cents per 1,000; but the gas is not in the pipes. It is certain, however, that a merry war is at hand; but despite its approach holders of Consolidated, Equitable and Mutual are not inclined to figure as bears. The Brooklyn situation is unchanged, so far as outward appearances go, and one of the strangest developments in the situation is the "quickening" of values in Equity bonds. Chicago gas is strong, having sold at 76¼ this morning. Bay State gas is gradually returning to its normal level. Consumers, of Jersey City, continues its upward march, as does Consolidated, of Baltimore.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

OCTOBER 22.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	121	122
Central	500,000	50	103	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	170	175
" Bonds	1,000,000	—	106	108
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	27	35
Preferred	5,000,000	100	79	82
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	116
Citizens	1,200,000	20	50	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	—	160
" Bonds	300,000		103	—
Peoples	1,000,000	10	75	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	145	—
" Bonds (5's)	70,000	—	—	155
Nassau	1,000,000	25	170	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	175	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	23	24
Income Bonds	2,000,000	1000	44	45
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	80	83
2d " " "	3,000,000	1000	59	—
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Chicago Gas Company.	25,000,000	100	76¼	76⅜
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	62	—
Bonds	600,000	1000	93	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			90	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	—	68½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
Con. Bonds	.....	.....	—	50
East River Gas Co., Long Island City	1,000,000	100	20	22
Preferred	.....	.....	36	38
Bonds	500,000	100	81	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn.	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky.	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	18	19
Preferred "	2,500,000	100	72	74
Bonds	9,034,400	1000	88¼	89
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn		25	200	—
Oakland, Cal.			42⅝	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City	500,000	—	175	185
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	71	71½
Washington, D. C.	2,000,000	20	240	—
Wilmington, Del.	500,000	50	188	190

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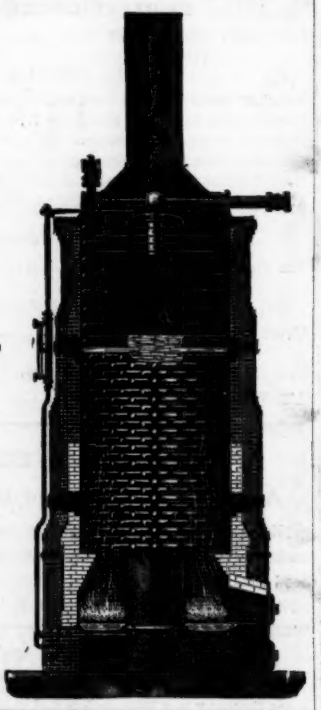

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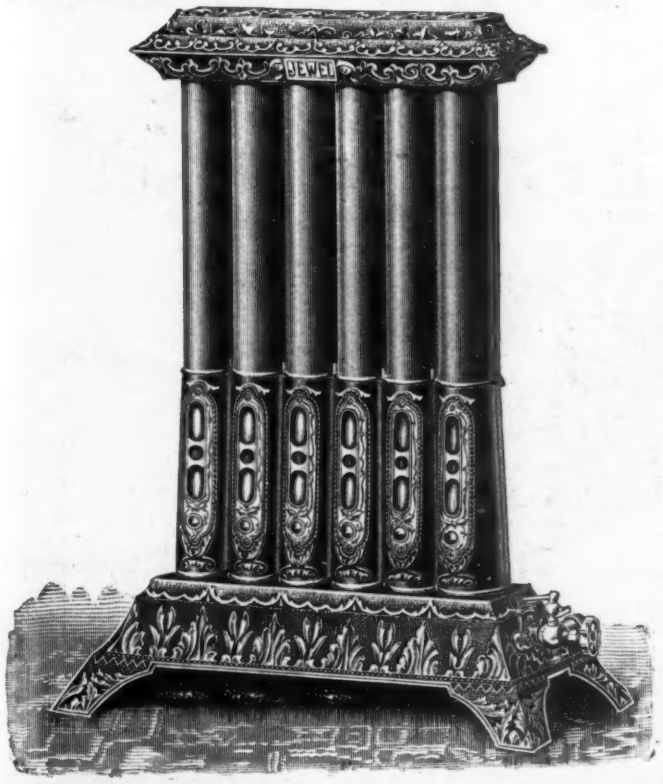

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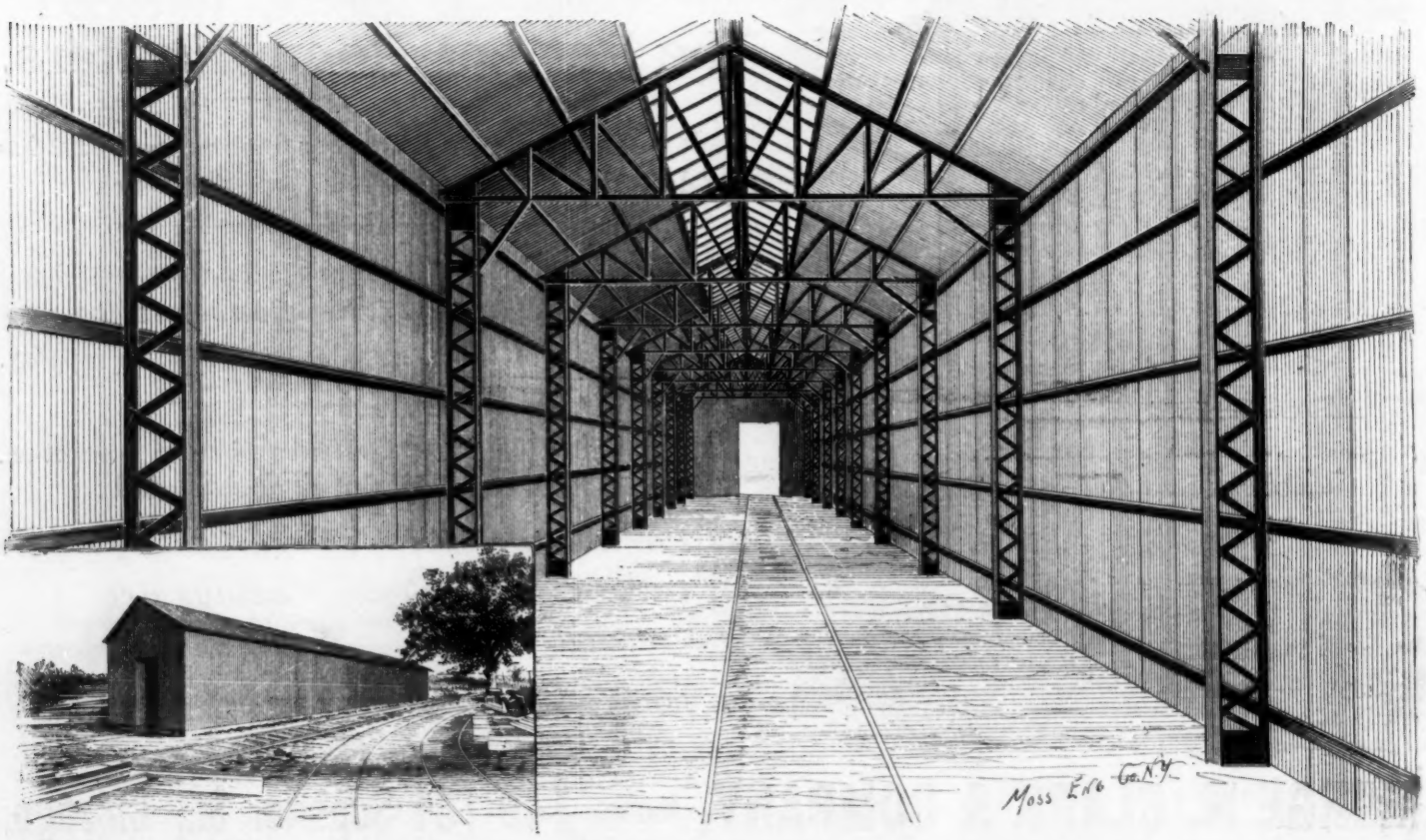

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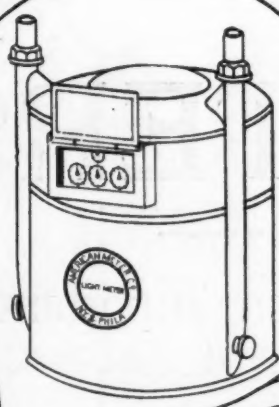

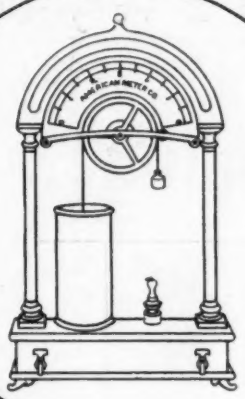

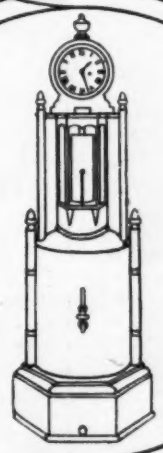

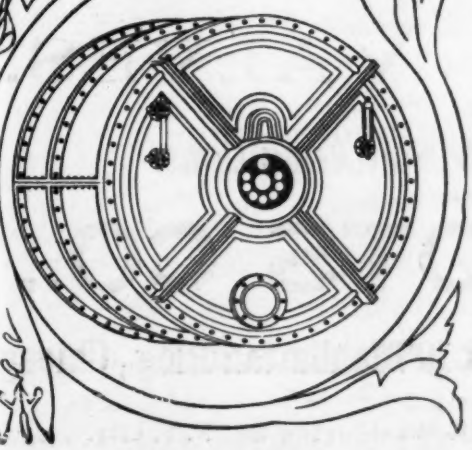

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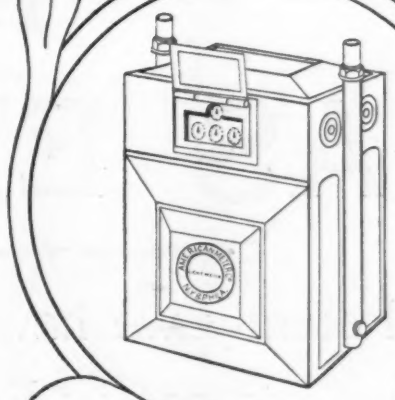
PUBLIC LIGHTING TABLE.

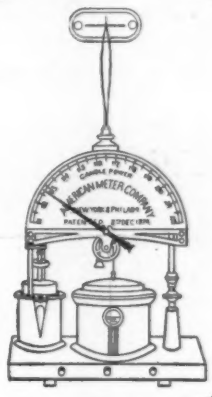
NOVEMBER, 1894.

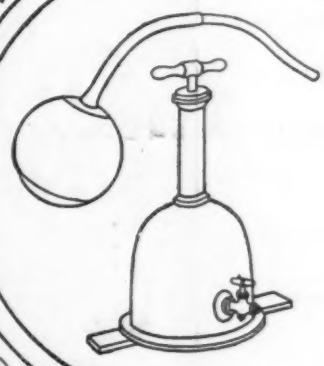
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	5.30 PM	5.30 AM	4.45	5.35
Fri.	2	7.20	5.30	4.45	5.35
Sat.	3	8.20	5.30	4.45	5.35
Sun.	4	9.20	5.30	4.45	5.35
Mon.	5	10.30 FQ	5.40	4.40	5.45
Tue.	6	11.30	5.40	4.40	5.45
Wed.	7	12.30 AM	5.40	4.40	5.45
Thu.	8	1.30	5.40	4.40	5.45
Fri.	9	2.40	5.40	4.40	5.45
Sat.	10	3.50	5.40	4.40	5.45
Sun.	11	No L.	No L.	4.40	5.45
Mon.	12	No L.	No L.	4.30	6.00
Tue.	13	No L. FM	No L.	4.30	6.00
Wed.	14	5.10 PM	6.30 PM	4.30	6.00
Thu.	15	5.10	7.30	4.30	6.00
Fri.	16	5.10	8.30	4.30	6.00
Sat.	17	5.10	9.50	4.30	6.00
Sun.	18	5.10	11.10	4.30	6.00
Mon.	19	5.10 LQ	12.20 AM	4.25	6.00
Tue.	20	5.10	1.30	4.25	6.00
Wed.	21	5.10	2.40	4.25	6.00
Thu.	22	5.10	3.50	4.25	6.00
Fri.	23	5.10	5.00	4.25	6.00
Sat.	24	5.10	6.00	4.25	6.00
Sun.	25	5.10	6.00	4.25	6.00
Mon.	26	5.10	6.00	4.20	6.10
Tue.	27	5.10 NM	6.00	4.20	6.10
Wed.	28	5.10	6.00	4.20	6.10
Thu.	29	5.10	6.00	4.20	6.10
Fri.	30	5.10	6.00	4.20	6.10

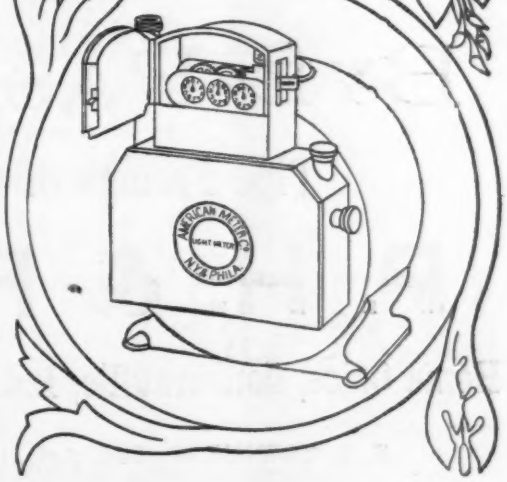
TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45









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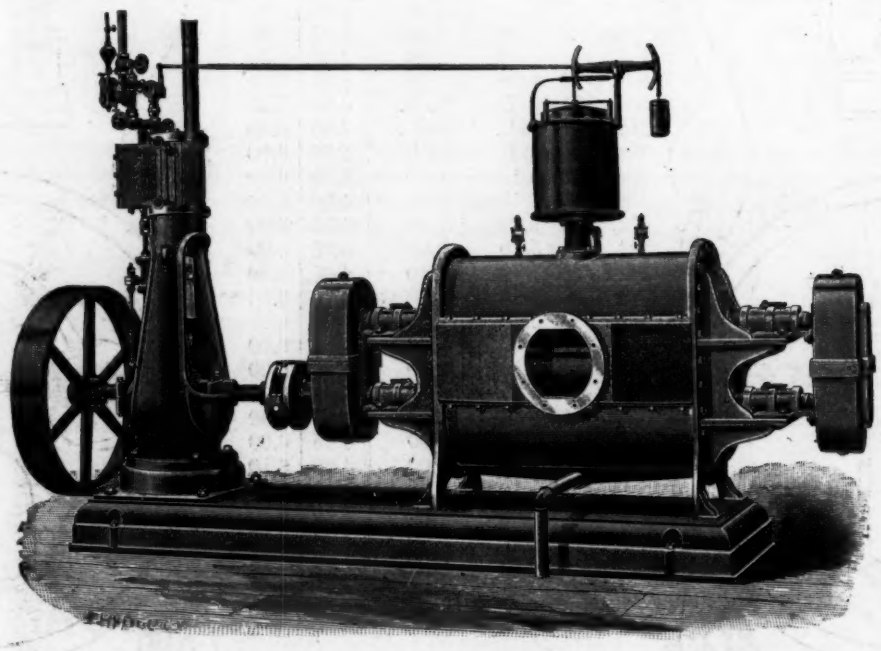

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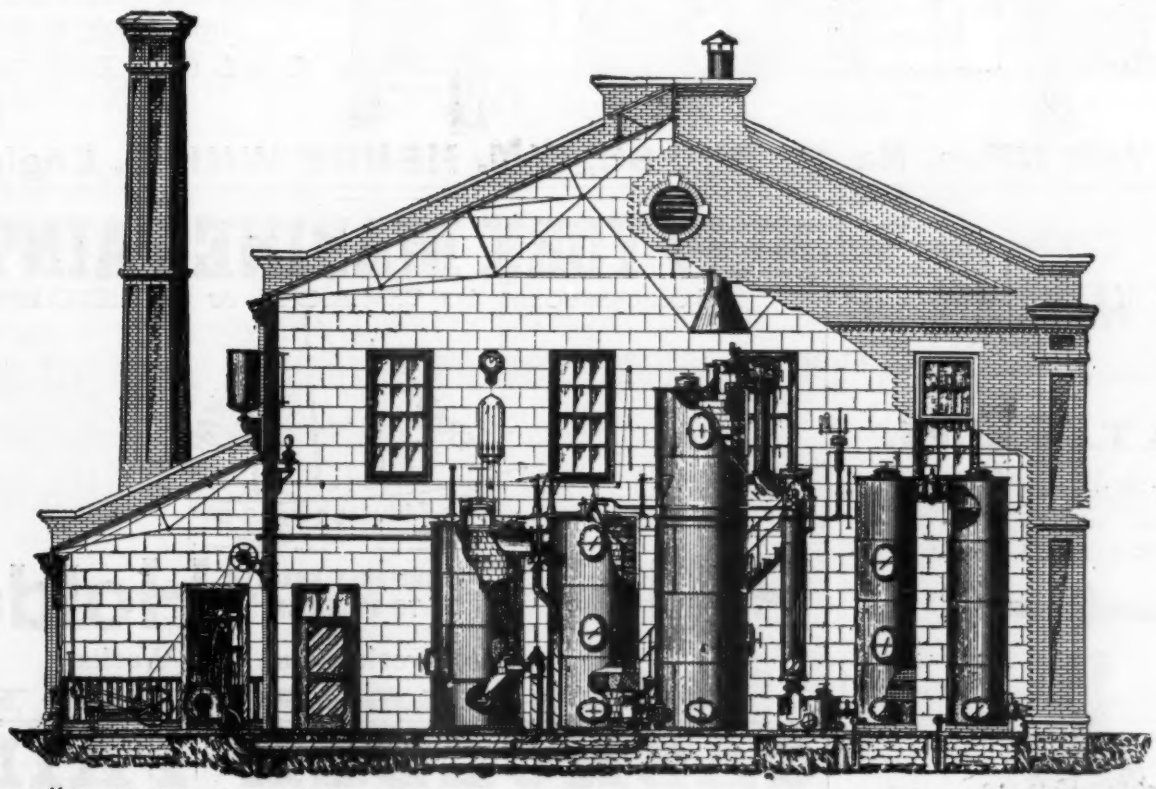

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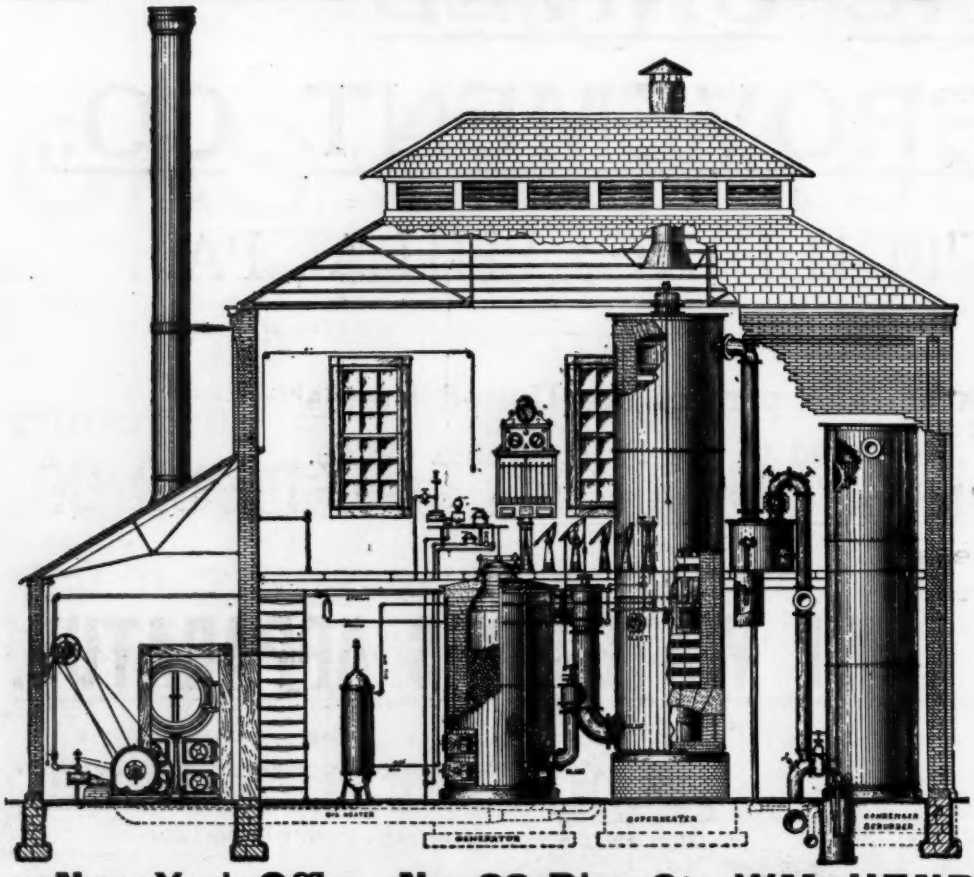

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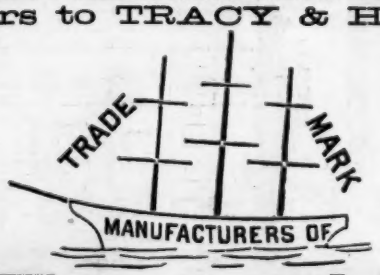

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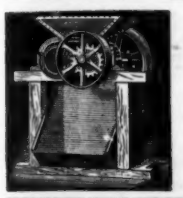

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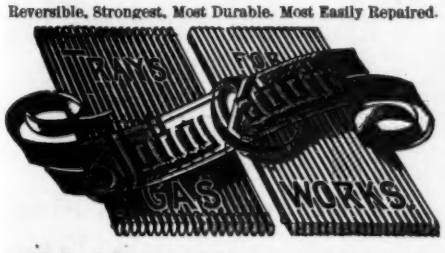

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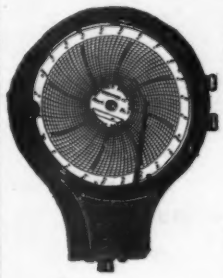

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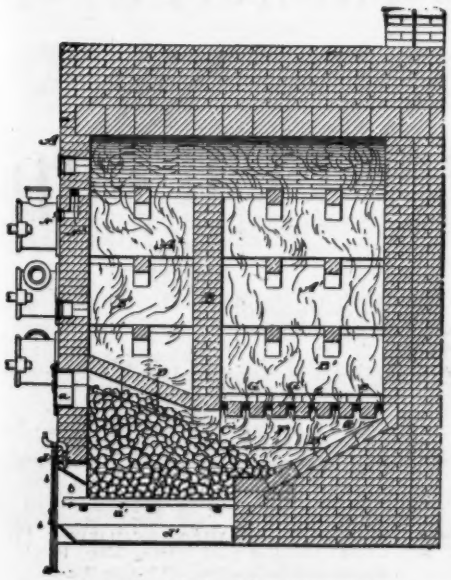

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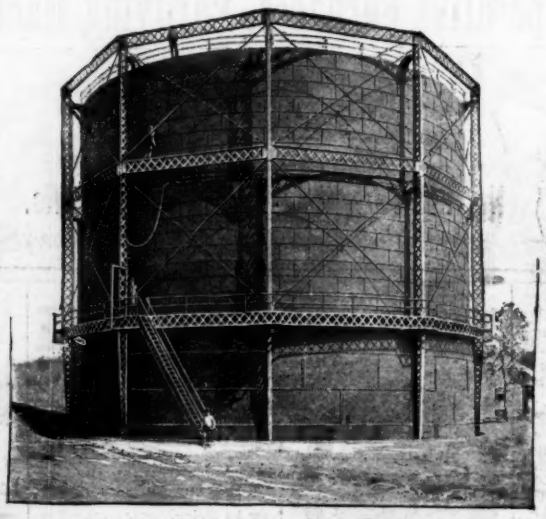

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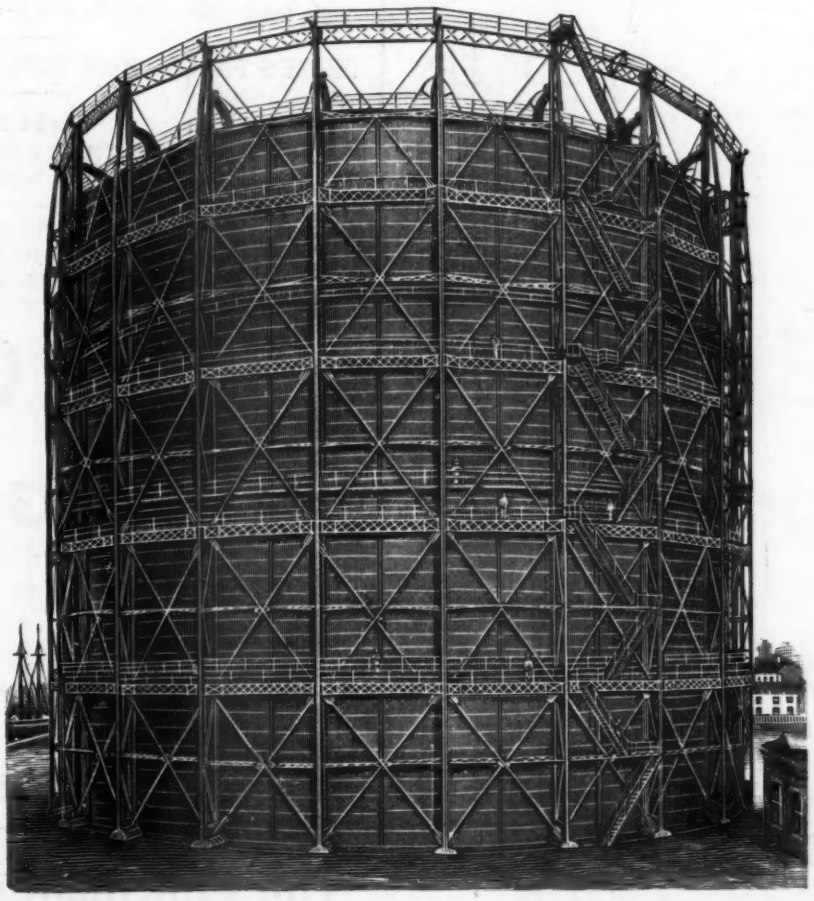

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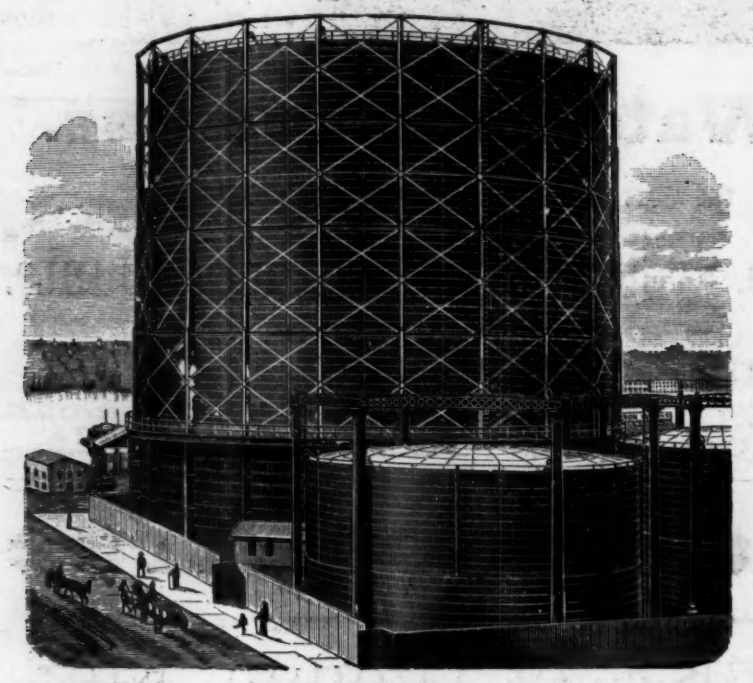

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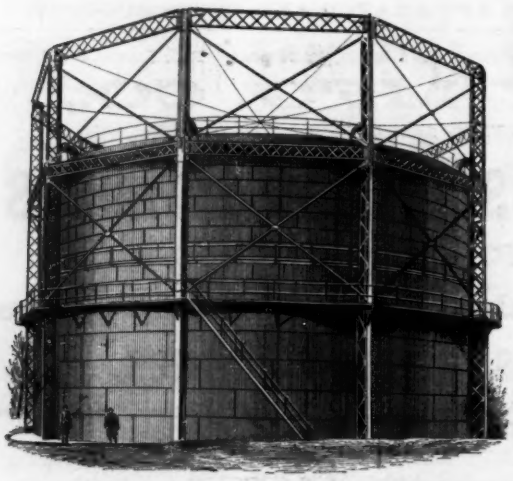

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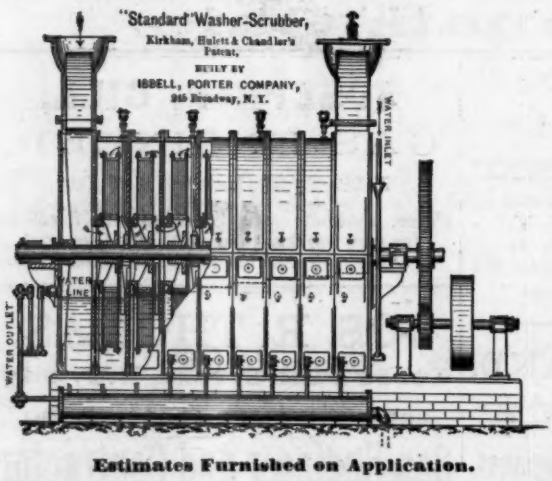

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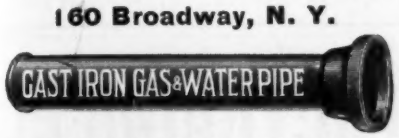

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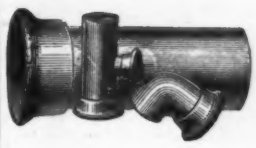

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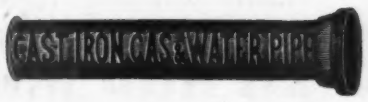

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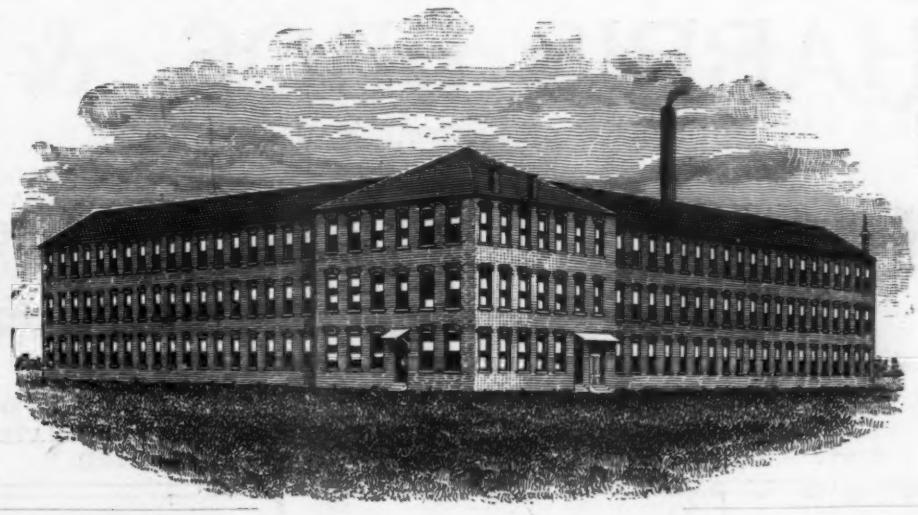

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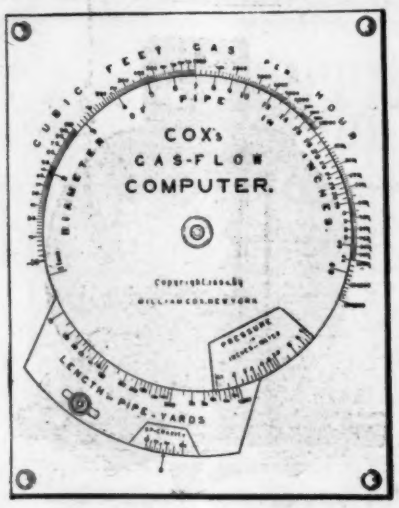

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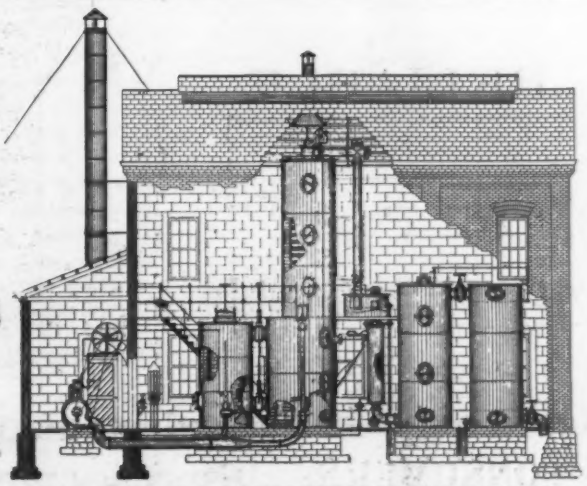

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